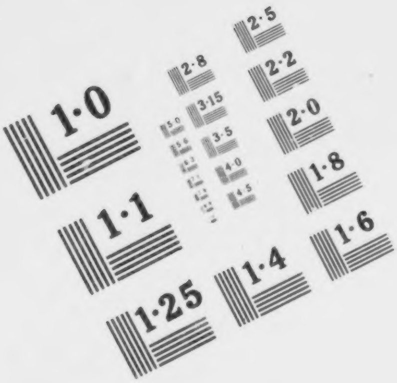

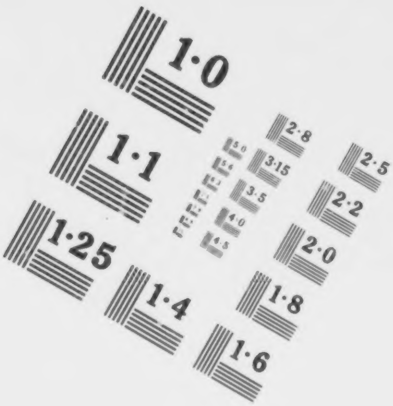

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READEX MICROPRINT CORP.
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USA

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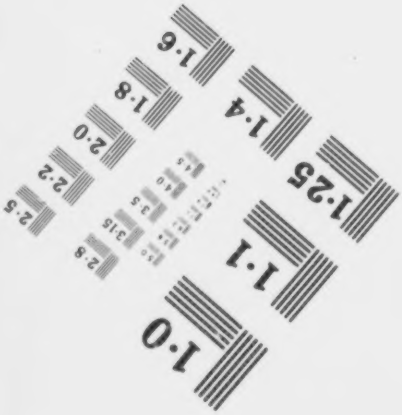
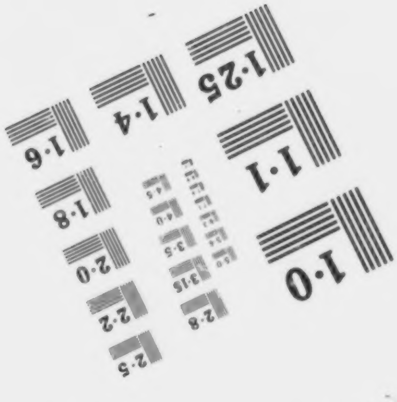




11-5820-610-14

TM 11-5820-610-14

TECHNICAL MANUAL

Operator's, Organizational, Direct Support and General Support Maintenance Manual
RADIO TERMINAL SET AN/TRC-133A
(NSN 5820-00-464-1616)

This copy is a reprint which includes current pages from Changes 1 through 5.

HEADQUARTERS, DEPARTMENT OF THE ARMY

JULY 1974

D101.11:

READEX FICHE best copy available

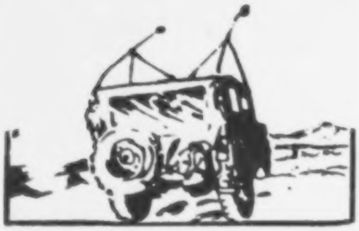
WARNING

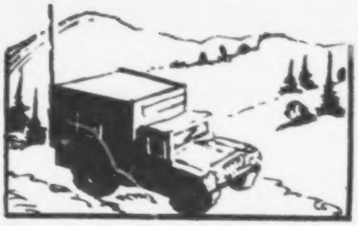
SERIOUS INJURY OR EVEN DEATH CAN HAPPEN IF THE FOLLOWING ARE NOT CAREFULLY OBSERVED WHEN INSTALLING AND USING THE ANTENNAS USED WITH YOUR RADIO SETS.

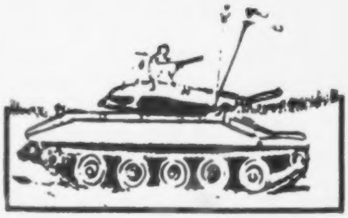
BEFORE ANY MISSION FIND OUT

1. ARE THERE ANY POWERLINES IN YOUR AREA OF OPERATION ?
2. HOW HIGH ARE THESE POWERLINES ?
3. HOW TALL ARE THE POLES OR TOWERS CARRYING POWERLINES ?

MOBILE OPERATION WITH WHIP ANTENNAS





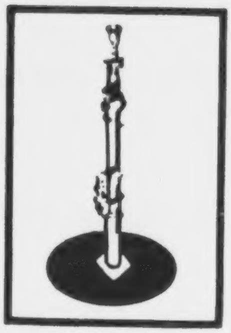


DO NOT STOP YOUR VEHICLE UNDER POWERLINES.

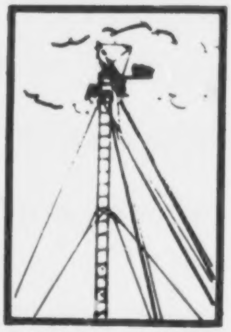
- IF POSSIBLE, TRY TO MAINTAIN MOBILE COMMUNICATIONS WITH YOUR ANTENNA(S) TIED DOWN.
- MAKE SURE AN ANTENNA TIP CAP IS SECURELY TAPED ON THE END OF EACH WHIP ANTENNA.
- DO NOT LEAN AGAINST OR TOUCH A WHIP ANTENNA WHILE THE TRANSMITTER IS ON.
- DURING CROSS-COUNTRY OPERATION, DO NOT ALLOW ANYONE TO STICK AN ARM, LEG OR WEAPON OVER THE SIDES OF THE VEHICLE. IF YOUR ANTENNA ACCIDENTALLY TOUCHES A POWERLINE AND A LEG, ARM OR WEAPON CONTACTS A DAMP BUSH OR THE GROUND, A SERIOUS OR FATAL ACCIDENT CAN HAPPEN.
- IF YOU ARE NOT SURE THAT AN ANTENNA ON YOUR VEHICLE WILL CLEAR A POWERLINE, STOP BEFORE YOU GET CLOSE TO THE POWERLINE AND EITHER CAREFULLY TIE DOWN THE ANTENNA OR REMOVE ANTENNA SECTIONS TO MAKE SURE THAT YOU CAN SAFELY DRIVE UNDER THE POWERLINE.

FIXED OPERATION WITH LONG RANGE ANTENNAS

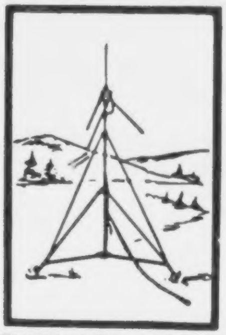
WARNING



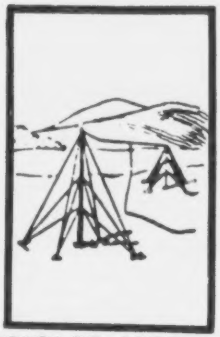
TELESCOPING ANTENNA MAST



TYPICAL TOWER



EXTENDED RANGE ANTENNA



DOUBLET ANTENNA

NEVER ERECT THESE LONG RANGE ANTENNAS DIRECTLY UNDER POWERLINES.

IF YOU MUST ERECT THESE LONG RANGE ANTENNAS NEAR POWERLINES, POWERLINE POLES OR TOWERS, OR BUILDINGS WITH OVERHEAD POWERLINE CONNECTIONS, NEVER PUT THE ANTENNA CLOSER THAN TWO TIMES THE ANTENNA HEIGHT FROM THE BASE OF THE POWERLINE, POLE, TOWER OR BUILDINGS.

NEVER ATTEMPT TO ERECT ANY LONG RANGE ANTENNA WITHOUT A FULL TEAM.

BEFORE ERECTING ANY LONG RANGE ANTENNA, INSPECT ALL THE PARTS MAKING UP THE ANTENNA KIT. DO NOT ERECT THE ANTENNA IF ANY PARTS ARE MISSING OR DAMAGED.

DO AS MUCH OF THE ASSEMBLY WORK AS POSSIBLE ON THE GROUND.

WHEN ERECTING THE ANTENNA, ALLOW ONLY TEAM PERSONNEL IN THE ERECTION AREA.

MAKE SURE THAT THE AREA FOR THE ANCHORS IS FIRM. IF THE GROUND IS MARSHY OR SANDY, GET SPECIFIC INSTRUCTIONS FROM YOUR CREW CHIEF OR SUPERVISOR ON HOW TO REINFORCE THE ANCHORS.

WHEN SELECTING LOCATIONS FOR ANCHORS, AVOID TRAVELED AREAS AND ROADS. IF YOU CANNOT AVOID THESE AREAS, GET SPECIFIC INSTRUCTIONS FROM YOUR SUPERVISOR AS TO WHAT CLEARANCE YOUR GUY WIRES AND ROPES MUST HAVE OVER THE TRAVELED AREAS AND ROAD.

CLEARLY MARK ALL GUY WIRES AND ROPES WITH THE WARNING FLAGS OR SIGNS SUPPLIED BY YOUR UNIT. IN AN EMERGENCY, USE STRIPS OF WHITE CLOTH AS WARNING STREAMERS.

IF YOU SUSPECT THAT POWERLINES HAVE MADE ACCIDENTAL CONTACT WITH YOUR ANTENNA, STOP OPERATING, ROPE OFF THE ANTENNA AREA, AND NOTIFY YOUR SUPERIORS.

IF THE WEATHER IN YOUR AREA CAN CAUSE ICE TO FORM ON YOUR LONG RANGE ANTENNA AND ITS GUY WIRES AND ROPES, ADD EXTRA GUYS TO SUPPORT THE SYSTEM. ROPE OFF THE AREA AND POST IT WITH WARNING SIGNS LIKE "BEWARE OF FALLING ICE."

DO NOT TRY TO ERECT ANY ANTENNA DURING AN ELECTRICAL STORM.

KEEP A SHARP EYE ON YOUR ANCHORS AND GUYS. CHECK THEM DAILY AND IMMEDIATELY BEFORE AND AFTER BAD WEATHER.

5 SAFETY STEPS TO FOLLOW IF SOMEONE IS THE VICTIM OF ELECTRICAL SHOCK

1 DO NOT TRY TO PULL OR GRAB THE INDIVIDUAL

2 IF POSSIBLE , TURN OFF THE ELECTRICAL POWER

3 IF YOU CANNOT TURN OFF THE ELECTRICAL POWER, PULL, PUSH, OR LIFT THE PERSON TO SAFETY USING A WOODEN POLE OR A ROPE OR SOME OTHER INSULATING MATERIAL

4 SEND FOR HELP AS SOON AS POSSIBLE

5 AFTER THE INJURED PERSON IS FREE OF CONTACT WITH THE SOURCE OF ELECTRICAL SHOCK, MOVE THE PERSON A SHORT DISTANCE AWAY AND IMMEDIATELY START ARTIFICIAL RESUSCITATION

WARNING

Adequate ventilation should be provided while using TRICHLOROTRIFLUOROETHANE. Prolonged breathing of vapor should be avoided. The solvent should not be used near heat or open flame; the products of decomposition are toxic and irritating. Since TRICHLOROTRIFLUOROETHANE dissolves natural oils, prolonged contact with skin should be avoided. When necessary, use gloves which the solvent cannot penetrate. If the solvent is taken internally, consult a physician immediately.

WARNING
RADIATION HAZARD

RADIOACTIVE MATERIAL
CONTROLLED DISPOSAL REQUIRED
ACCOUNTABILITY NOT REQUIRED
STD RW –2

Voltmeter	Ra 226	0.55uCi	6625-00-555-3095

Radiation Hazard Information: The following radiation hazard information must be read and understood by all personnel before operating or repairing Radio Terminal Set AN/TRC-133A. Hazardous radioactive materials are present in the above listed component of the AN/TRC-133A.

The component is potentially hazardous when broken. See qualified medical personnel and the local Radiological Protection Officer (RPO) immediately, if you are exposed to or cut by a broken component. First aid instructions are contained in TB 43-0116, TB 43-0122, and AR 755-15.

NEVER place radioactive components in your pocket.

Use extreme care NOT to break radioactive components while handling them.

NEVER remove radioactive components from cartons until you are ready to use them.

If any of these components are broken, notify the local RPO immediately. The RPO will survey the immediate area for radiological contamination and will supervise the removal of broken components.

The above listed radioactive components *will not* be repaired or disassembled.

Disposal of broken, unserviceable, or unwanted radioactive components will be accomplished in accordance with the instructions in AR 755-15.

Information in this publication contained in sections I, II, IV, and VI of appendix E has been provided to the Government for the purpose of operation and maintenance only and is not to be reproduced, in whole or in part without approval of the manufacturer.

***TM 11-5820-610-14**

TECHNICAL MANUAL
No. 11-5820-610-14

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, DC, *2 July 1974*

OPERATOR'S ORGANIZATIONAL, DIRECT SUPPORT AND GENERAL SUPPORT MAINTENANCE MANUAL

RADIO TERMINAL SET AN/TRC-133A (NSN 5820-00-464-1616)

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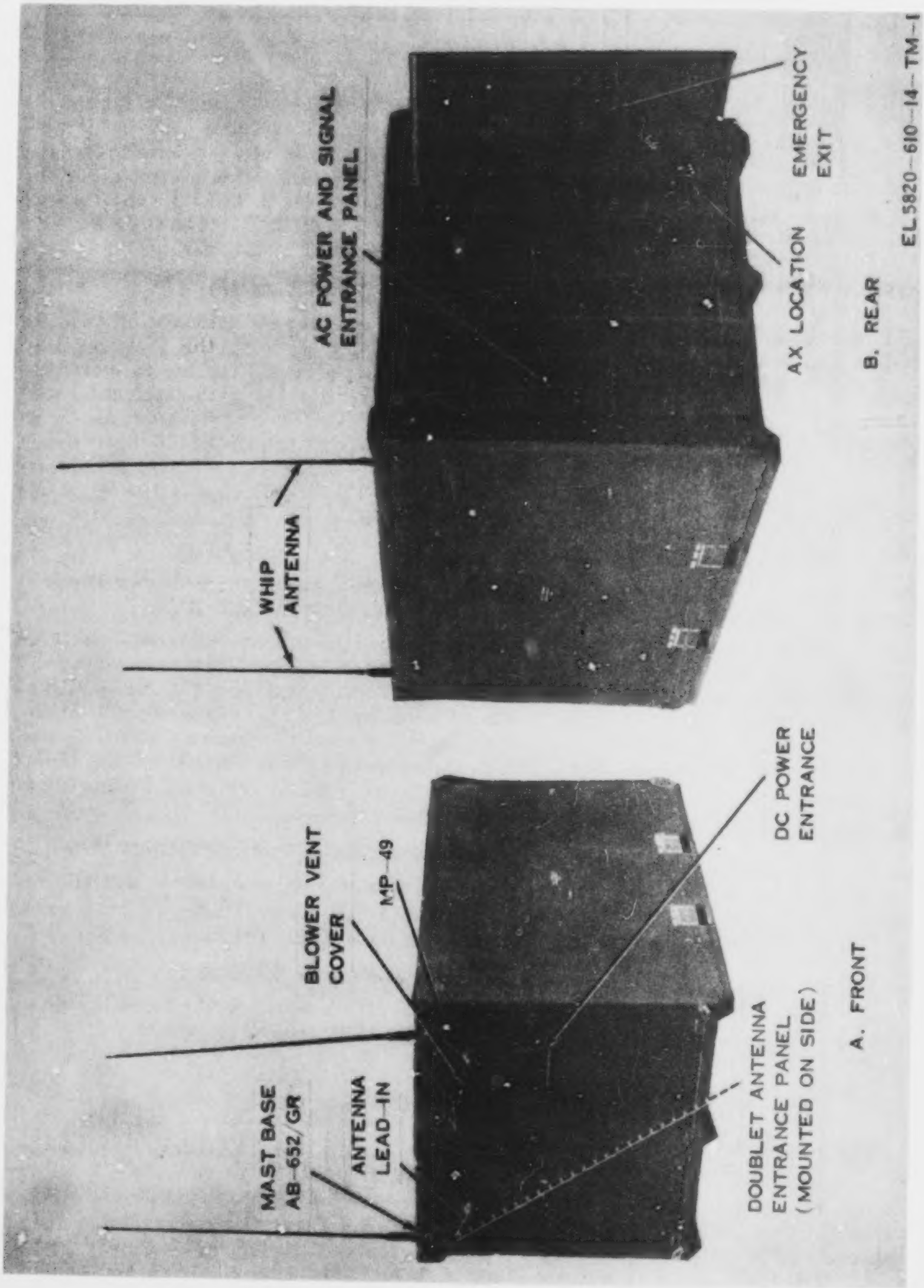
MAST BASE AB-652/GR
ANTENNA LEAD-IN
BLOWER VENT COVER
MP-49
DOUBLET ANTENNA ENTRANCE PANEL (MOUNTED ON SIDE)
DC POWER ENTRANCE
A. FRONT
WHIP ANTENNA
AC POWER AND SIGNAL ENTRANCE PANEL
AX LOCATION
EMERGENCY EXIT
B. REAR
EL5820-610-14-TM-1

Figure 1-1. Radio Terminal Set AN/TRC-133A, external

CHAPTER 1
INTRODUCTION

Section I. GENERAL

1-1. Scope

a. This manual describes Radio Terminal Set AN/TRC-133A. The manual contains instructions for the installation, operation, and maintenance of the radio terminal, including construction and erection of the antennas used in conjunction with the equipment.

b. Also included in the manual is appendix A (References), appendix B (Basic Issue Items), appendix C (Maintenance Allocation), and appendix E (Maintenance Instruction Sheets).

NOTE

Throughout this manual, where appropriate, references are made to other publications which cover the installation, operation, and maintenance of equipments that are installed in the radio terminal. A complete listing of all applicable reference publications is provided in appendix A.

1-2. Indexes of Publications

a. DA Pam 310-4. Refer to DA Pam 310-4 to determine whether there are new editions, changes, or additional publications pertaining to the equipment.

b. DA Pam 310-7. Refer to DA Pam 310-7 to determine whether there are Modification Work Orders (MWO's) pertaining to the equipment.

1-3. Forms and Records

a. Reports of Maintenance and Unsatisfactory Equipment. Maintenance forms, records, and reports which are to be used by maintenance personnel at all maintenance levels are listed in and prescribed by TM 38-750.

b. Report of Packaging and Handling Deficiencies. Fill out and forward DD Form 6 (Packaging Improvement Report) as prescribed in AR 700-58/NAVSUPINST 4030.29/AFR 71-13/MCO P4030.29A, and DLAR 4145.8.

c. Discrepancy in Shipment Report (DISREP) (SF 361). Fill out and forward Discrepancy in Shipment Report (DISREP) (SF 361) as prescribed in AR 55-38/NAVSUPINST 4610.33 B/AFR 75-18/MCO P4610.19C and DLAR 4500.15.

1-3.1. Reporting of Errors

Reporting of errors, omissions, and recommendations for improving this manual by the individual user is encouraged. Reports should be submitted on DA Form 2028 (Recommended Changes to Publications and Blank Forms) and forwarded direct to: Commander, US Army Communications and Electronics Materiel Readiness Command, ATTN: DRSEL-ME-MQ, Fort Monmouth, NJ 07703.

1-3.2. Reporting Equipment Improvement Recommendations (EIR)

EIR's will be prepared using Standard Form 368, Quality Deficiency Report. Instructions for preparing EIR's are provided in TM 38-750. EIR's should be mailed direct to Commander, US Army Communications and Electronics Materiel Readiness Command, ATTN: DRSEL-ME-MQ, Fort Monmouth, NJ 07703. A reply will be furnished direct to you.

1-4. Destruction to Prevent Enemy Use

Destruction of the radio terminal set will be accomplished only upon the order of the commander. Refer to TM 750-244-2.

1-5. Administrative Storage

For administrative storage of the Radio Terminal Set AN/TRC-133A, refer to paragraph 5-1.

Section II. DESCRIPTION AND DATA

1-6. Description of Radio Terminal Set AN/TRC-133A

a. Purpose and Use.

(1) The purpose of the AN/TRC-133A is to provide a vehicular transported configuration of five high-frequency, single sideband radio transceivers.

(2) The AN/TRC-133A is used by Army tactical units in accordance with requirements set down by the commanders.

b. General. The AN/TRC-133A is a single sideband, voice radio terminal mounted in a S-280A/G type of shelter (fig. 1-1) with radio equipment installed. A 2½-ton truck, not supplied as part of the terminal, can be used to transport the radio terminal and to pull a power unit trailer containing two 10-kilowatt alternating current (ac) engine generators, which also are not supplied. Refer to paragraph 1-10 for a complete list of components of the radio terminal set.

c. Communication Facilities. (figs. 1-2 through 1-5).

(1) *Shelter.* The AN/TRC-133A shelter contains five radio positions, each using Receiver-Transmitter, Radio RT-718/FRC-93 (fig. 1-6) with Control, Radio Set C-6118/FRC-93, Power Supply PP-4151/FRC-93, Crystal Unit Set, Quartz CK-31FRC-93, and Microphone, Dynamic M-127/FRC-93. Each of the five operating positions can be connected to separate doublet antennas provided as part of the radio terminal. Positions 1 and 2 can also be operated with separate 15-foot whip antennas, which are used when the radio terminal set is operated mobile. The five radio equipments are powered from a 115-volt, 60 Hertz (Hz), single phase ac power source through the ac power and signal entrance panel (fig. 1-7) when the terminal is in a fixed or semifixed position. During mobile operation, the radio equipment located at positions 1 and 2 is powered from the 28-volt direct current (dc) vehicular electrical system through the dc power and signal entrance panel (A, fig. 1-8) in conjunction with dc Power Supply PP-4765/GRC-159(V) (Collins Model 516E-2). Tuner, Radio Frequency TN-339/GR is provided for use with the whip antenna when operating below 20 MegaHertz (MHz). In addition, Amplifier, Radio Frequency AM-3979/FRC-93 is provided to allow any one of the five positions to transmit on increased output power to extend the operating range of the position so selected. Each radio position is connected to the antenna entrance panel located near the ceiling in the front right corner of the shelter.

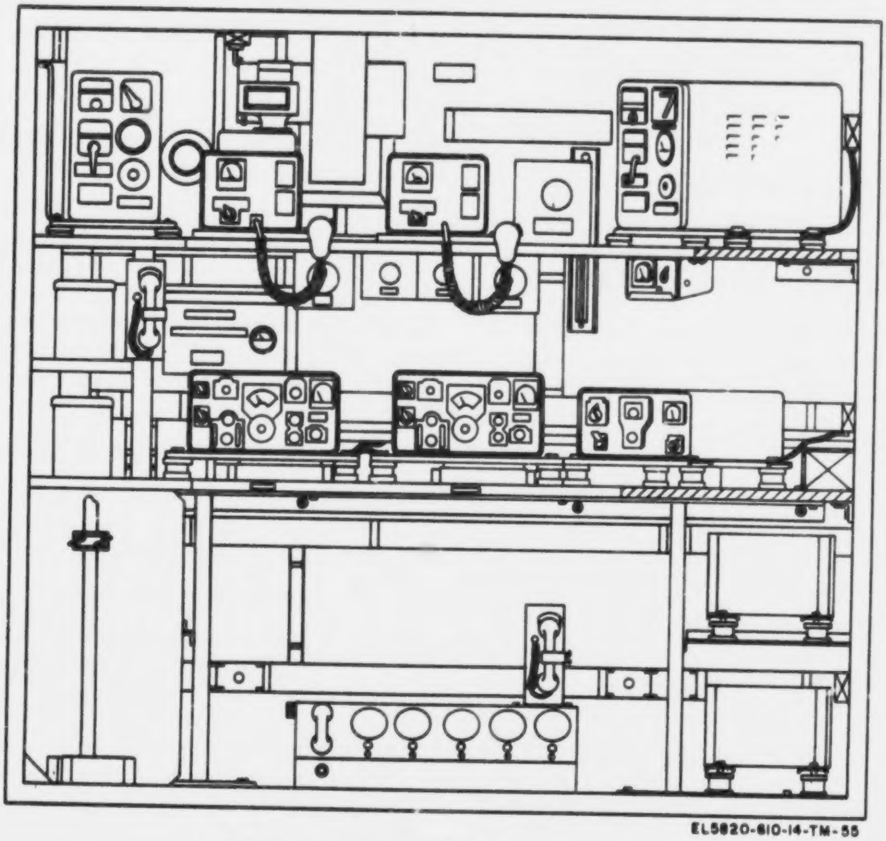
EL5820-610-14-TM-55

Figure 1-2. AN/TRC-133A shelter interior, front.

the whip antenna when operating below 20 MegaHertz (MHz). In addition, Amplifier, Radio Frequency AM-3979/FRC-93 is provided to allow any one of the five positions to transmit on increased output power to extend the operating range of the position so selected. Each radio position is connected to the antenna entrance panel located near the ceiling in the front right corner of the shelter.

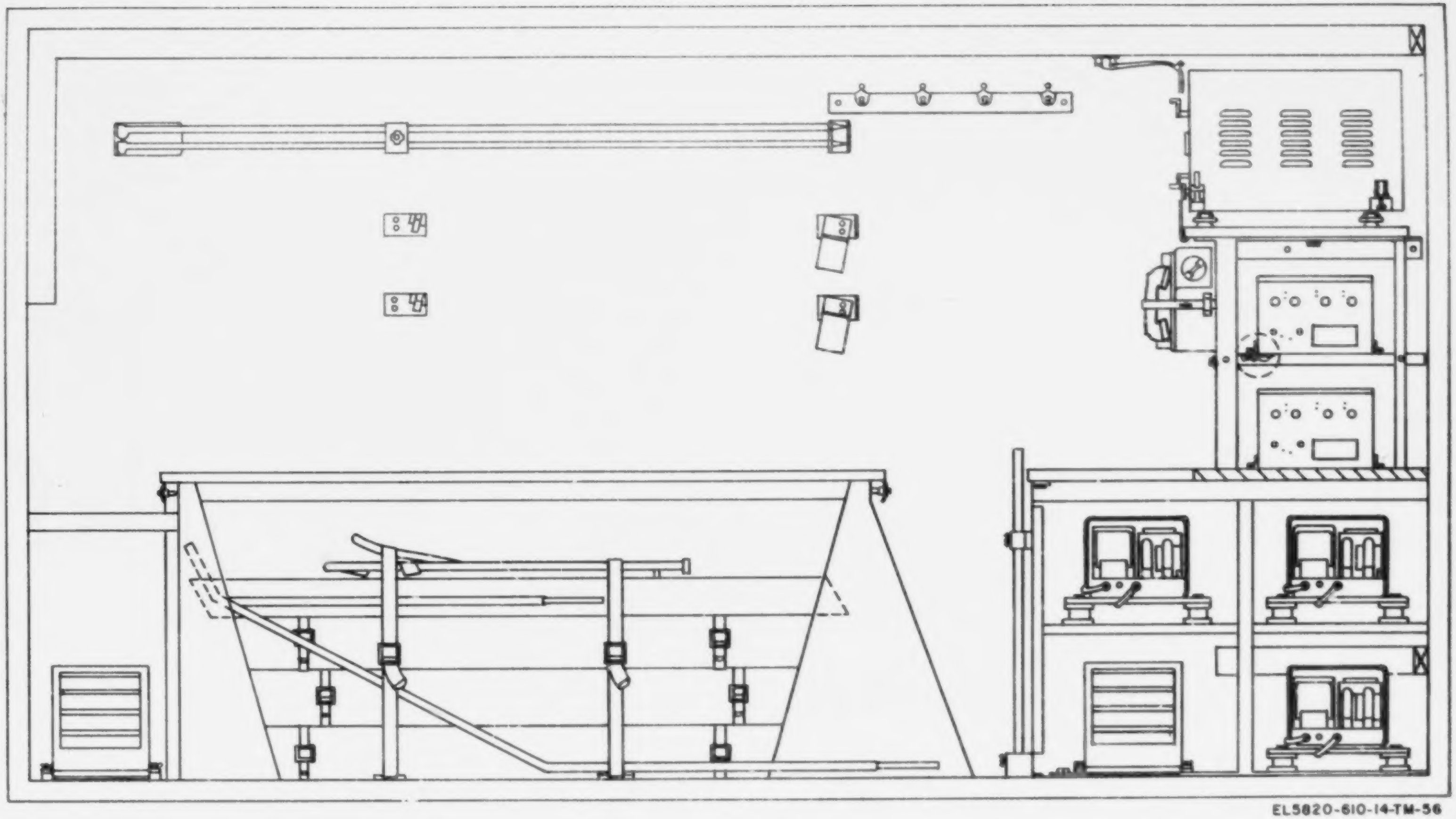
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Figure 1-3. AN/TRC-133A shelter interior, roadside.

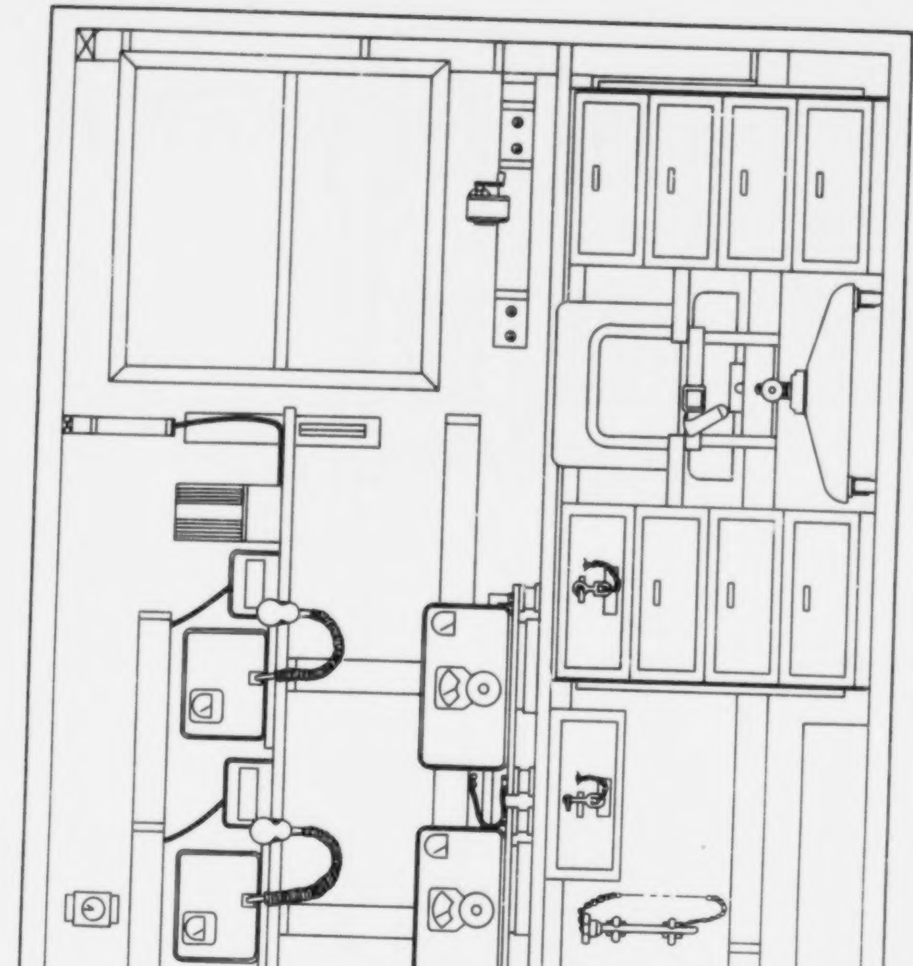

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Figure 1-4. AN/TRC-133A shelter interior, curbside.

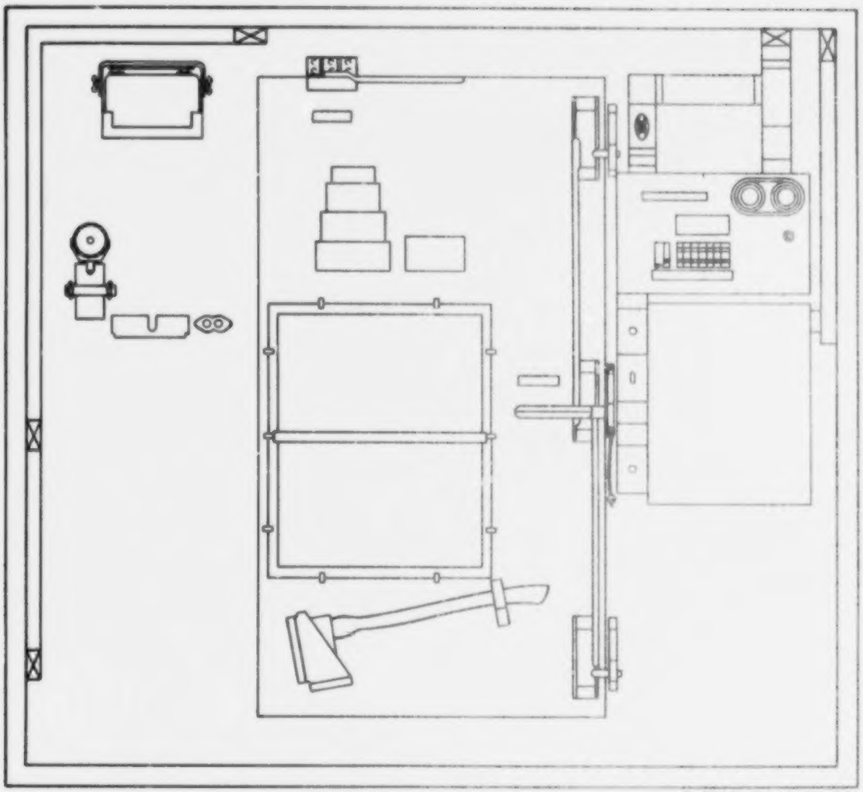


Figure 1-5. AN/TRC-133A shelter interior, rear.

(2) *Antennas.*

(a) Provisions are made for mounting of two 15-foot whip antennas on the outside front wall of the shelter (fig. 1-1). The whip antennas are used during mobile operation.

(b) Sufficient components and associated hardware are furnished to allow construction and erection of five doublet antennas for use when the radio terminal set is operated in the fixed or semifixed mode.

(c) A storage area for stowing the doublet antenna components is located on the roadside floor of the shelter interior (fig. 1-6).

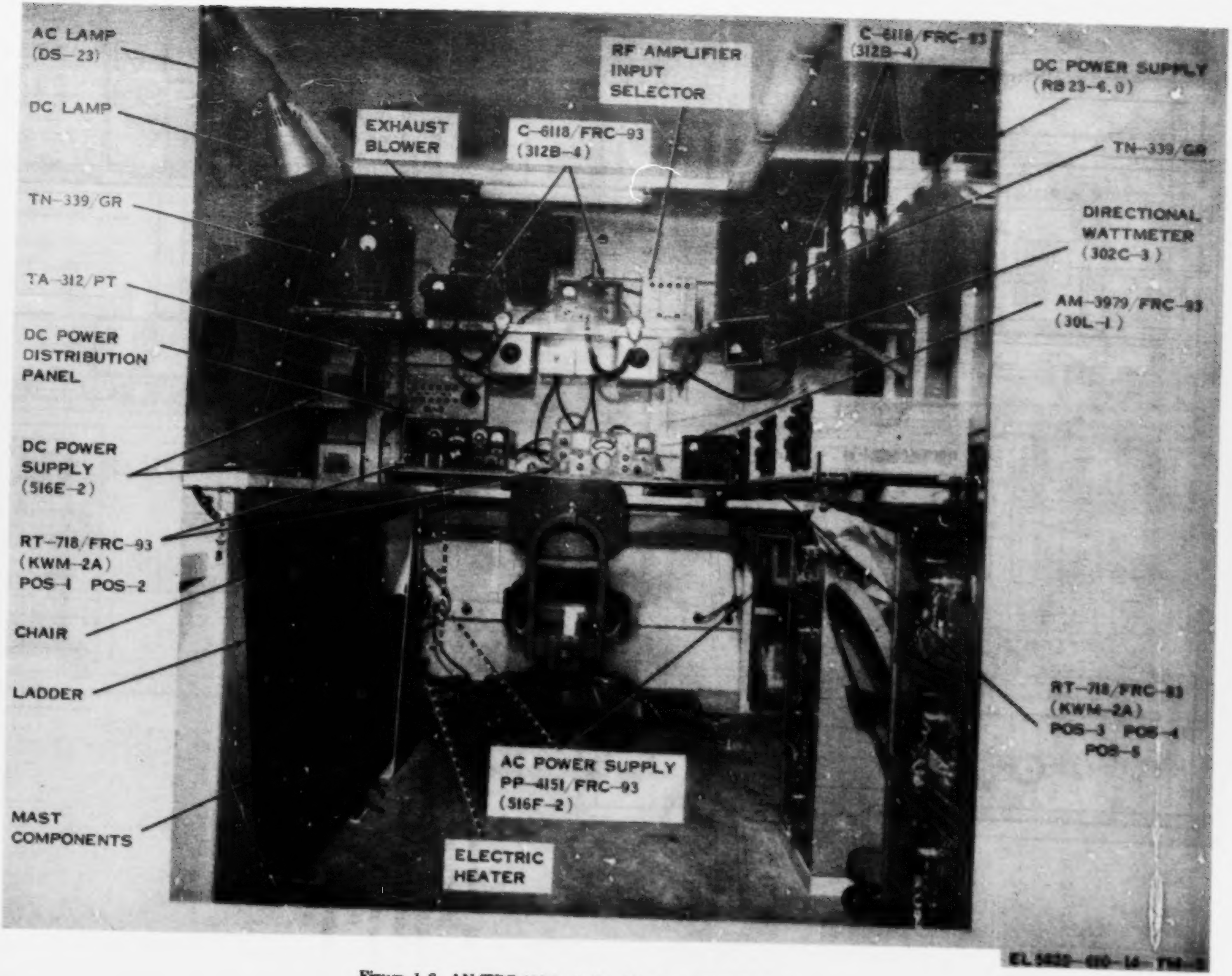

AC LAMP (DS–23)
DC LAMP
TN–339/GR
TA–312/PT
DC POWER DISTRIBUTION PANEL
DC POWER SUPPLY (516E–2)
RT–718/FRC–93 (KWM–2A) POS–1 POS–2
CHAIR
LADDER
MAST COMPONENTS
EXHAUST BLOWER
C–6118/FRC–93 (312B–4)
RF AMPLIFIER INPUT SELECTOR
C–6118/FRC–93 (312B–4)
DC POWER SUPPLY (RB 23–6, 0)
TN–339/GR
DIRECTIONAL WATTMETER (302C–3)
AM–3979/FRC–93 (30L–1)
RT–718/FRC–93 (KWM–2A) POS–3 POS–4 POS–5
AC POWER SUPPLY PP–4151/FRC–93 (516F–2)
ELECTRIC HEATER
EL 5820–610–14–TM–5

Figure 1-6. AN/TRC-133A shelter interior, forward view.

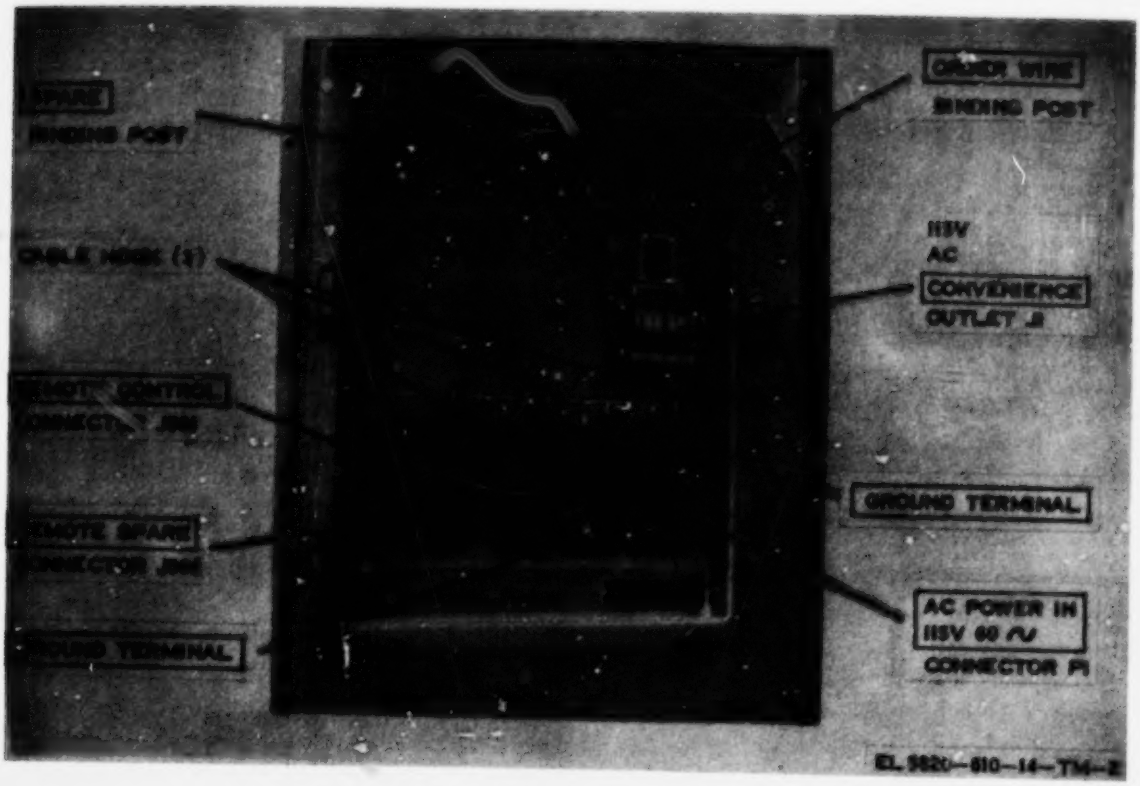

SPARE
BINDING POST
CABLE HOOK (2)
REMOTE CONTROL
CONNECTOR
REMOTE SPARE
CONNECTOR
ROUND TERMINAL
ORDER WIRE
BINDING POST
115V
AC
CONVENIENCE
OUTLET J2
GROUND TERMINAL
AC POWER IN
115V 60 ∿
CONNECTOR P1
EL 5820-610-14-TM-2

Figure 1-7. AC POWER AND SIGNAL ENTRANCE PANEL.

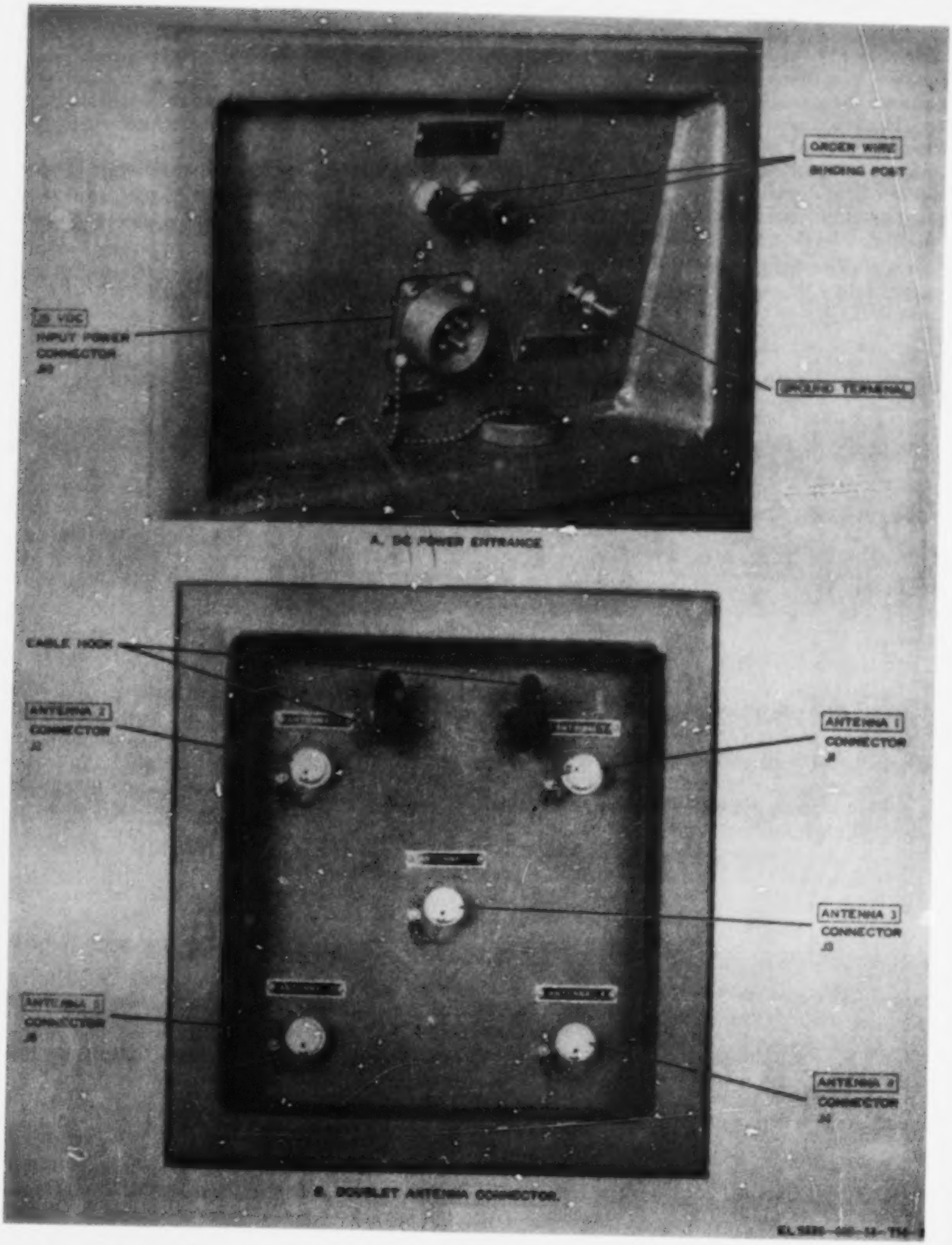

ORDER WIRE BINDING POST
VDC INPUT POWER CONNECTOR
GROUND TERMINAL
A. DC POWER ENTRANCE
CABLE HOOK
ANTENNA 2 CONNECTOR J2
ANTENNA 1 CONNECTOR J1
ANTENNA 3 CONNECTOR J3
ANTENNA 5 CONNECTOR J5
ANTENNA 4 CONNECTOR J4
B. DOUBLET ANTENNA CONNECTOR.

Figure 1-8. External entrance panel.

(3) *Remote control facilities.*

(a) A remote control console (fig. 1-9) is provided to allow operation from a remote site. All five positions can be operated, as required, with necessary operating controls located on the front panel of the remote control console. Either a microphone or telephone handset can be used for operation. Front panel indicator lamps are provided to visually alert the remote control console operator that a signal has been received at that position. Two jacks are provided at each remote control console position to permit handset, or headset and speaker, monitoring. The remote control console contains a volume control at each position for adjusting the audio signal level.

(b) A telephone order-wire circuit, contained in the remote cable assemblies, is provided between the remote site and the shelter. Telephone Set TA-312/PT is used at each end of the order-wire circuit.

(c) Three 500-foot long signal cable assemblies are provided to interconnect the shelter with the remote control console, positioned at a site up to 1500 feet away from the shelter.

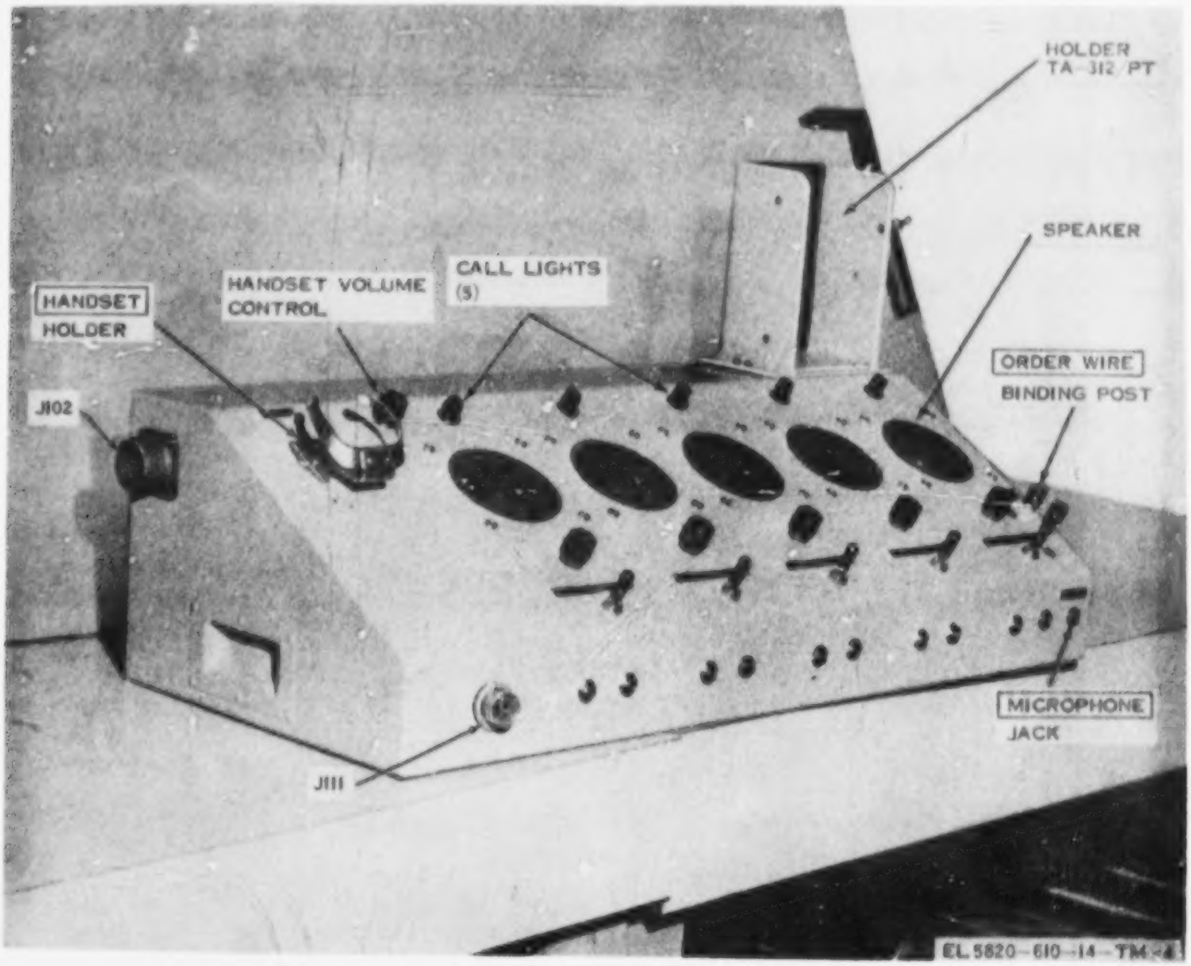


Figure 1-9. Remote control console.

(4) *Shelter facilities and controls* (fig. 1-6).

(a) Two dummy loads and a directional wattmeter are provided to load the transceiver for initial tuneup, for tuneup to a new frequency, or for test purposes.

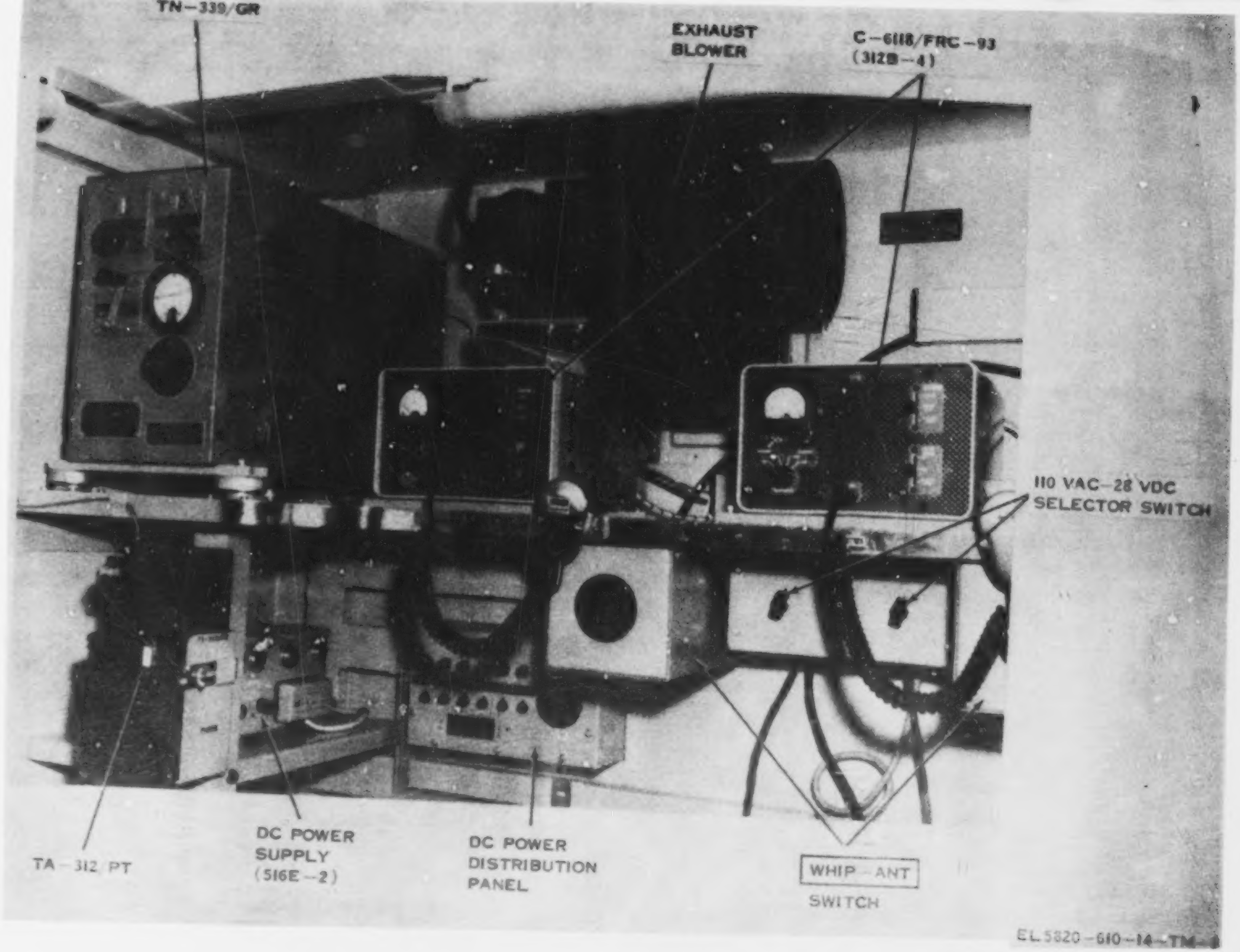
(b) Two WHIP-ANT switchboxes (fig. 1-10) are provided for switching the output from positions 1 and/or 2 radio equipment to either the doublet antennas or through Antenna Tuning Units TN-339/GR to the whip antennas.

(c) A dc power distribution panel and the two 110VAC-28VDC switchboxes (fig. 1-10) control dc voltage to the equipment of positions 1 and 2, a dc lamp, and a dc fan, when the radio terminal set is mobile. The 28-volt dc power is supplied by the batteries of the carrying vehicle.

(d) Five coaxial relays, contained in rf switching relay boxes (fig. 1-11), are located near the C-6118/FRC-93's for positions 3, 4, and 5 and in the WHIP-ANT switchboxes located at positions 1 and

2. When one of the RT-718/FRC-93 transceivers is switched for operation with the AM-3979/FRC-93, the other four relays operate to prevent their respective units from being connected into the AM-3979/FRC-93.

(e) An RF AMPLIFIER INPUT SELECTOR switchbox (fig. 1-6) controls selection of one of the five operating positions for operation with the AM-3979/RFC-93.


TN-339/GR
EXHAUST BLOWER
C-6118/FRC-93 (312B-4)
110 VAC-28 VDC SELECTOR SWITCH
TA-312 PT
DC POWER SUPPLY (516E-2)
DC POWER DISTRIBUTION PANEL
WHIP-ANT SWITCH

EL5820-610-14-TM-8

Figure 1-10. AN/TRC-133A shelter interior, left upper corner view.

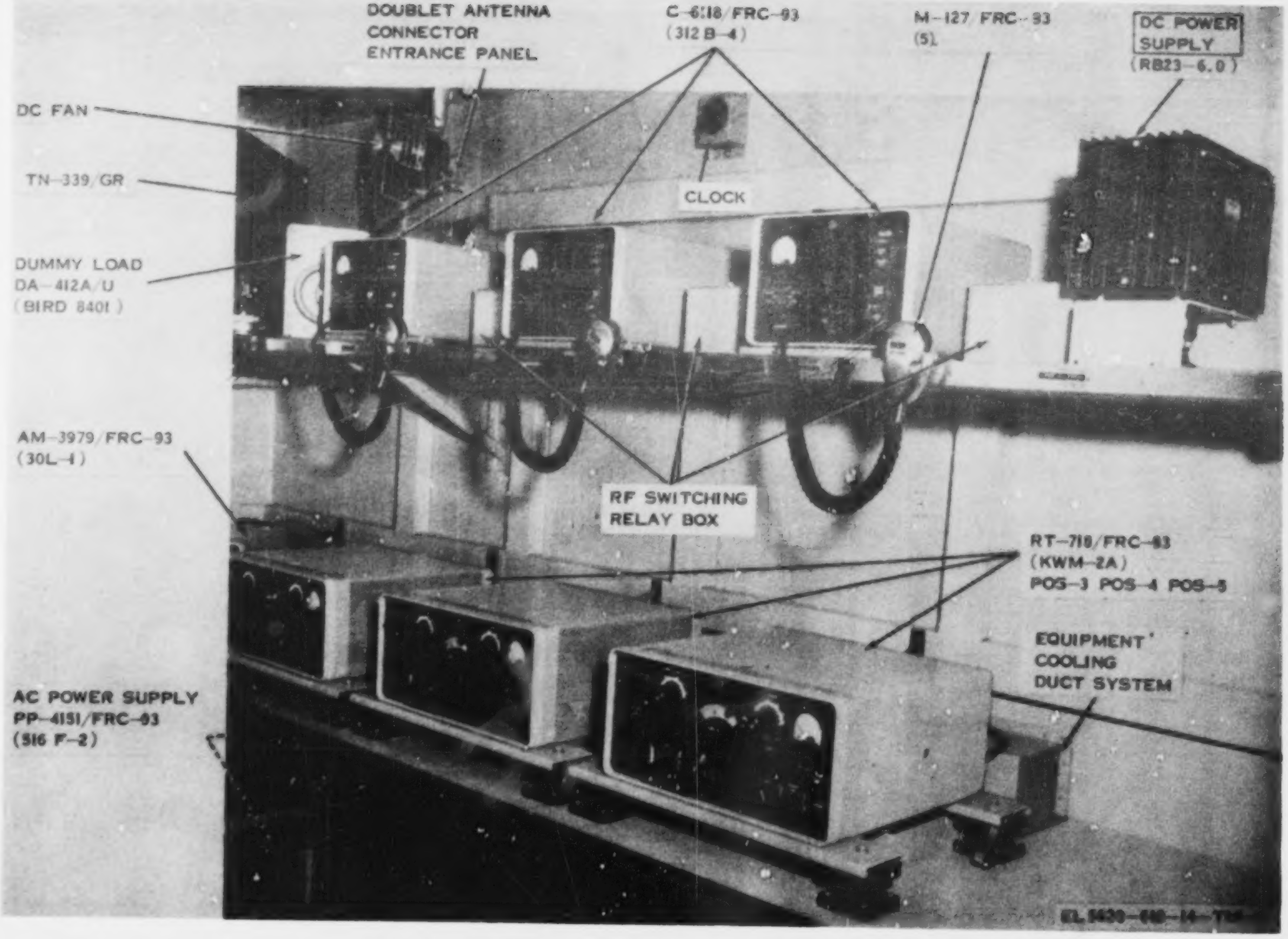

DOUBLET ANTENNA
CONNECTOR
ENTRANCE PANEL
C-6118/FRC-93
(312 B-4)
M-127/FRC-93
(5)
DC POWER
SUPPLY
(RB23-6.0)
DC FAN
TN-339/GR
CLOCK
DUMMY LOAD
DA-412A/U
(BIRD 8401)
AM-3979/FRC-93
(30L-4)
RF SWITCHING
RELAY BOX
RT-718/FRC-93
(KWM-2A)
POS-3 POS-4 POS-5
EQUIPMENT
COOLING
DUCT SYSTEM
AC POWER SUPPLY
PP-4151/FRC-93
(516 F-2)

Figure 1-11. AN/TRC-133A shelter interior, forward right side wall.

d. Heater (fig. 1-12). The two thermostatically controlled heaters in the shelter contain a 1,500-watt heating element. A swtich on the top of the heater permits the heating element and fan to be operated together; the fan can also be operated alone for air circulation.

e. Ventilation and Lighting (fig. 1-6).

(1) A blower on the front wall draws in air through a filtered intake on the shelter door and exhausts the air out the front of the shelter. The blower is operated from ac primary power.

(2) A duct system, employing a blower, is provided for forced-air ventilation of the five operating positions in the shelter. A filter is used with the duct blower to clean the air before it is ducted into the transceivers. The airflow is directed to the bottom surface of the transceiver chassis at a rate of 50 to 75 cubic feet per minute.

(3) A dc powered, ceiling mounted fan (fig. 1-11) is provided for air circulation while operating in mobile mode.

(4) Fluorescent lamps, located on the ceiling, furnish ac lighting in the shelter. They are controlled by a FLUORESCENT LIGHT switch (fig. 1-13) located on the rear wall near the door.

(5) Incandescent lamps (fig. 1-13, 1-14) are located on the roadside ceiling toward the rear of the shelter. They are controlled by the INCANDESCENT LIGHT swiтch located on the rear wall near the door. The light swtich is a push-on, push-off variable dimmer type.

(6) The dc lamp (fig. 1-6), located on the front roadside ceiling, is powered by the vehicle electrical system and furnishes light while in the mobile mode or for emergency use.

(7) Blackout protection is provided by the BLACKOUT-BYPASS switch (fig. 1-13) on the rear wall. When at BLACKOUT, the lights will go out when the door is opened; at BYPASS, the lights will go out when the door is opened.

f. Signal and Power Entrance Panel (Exterior) (fig. 1-7). An ac power and signal entrance panel

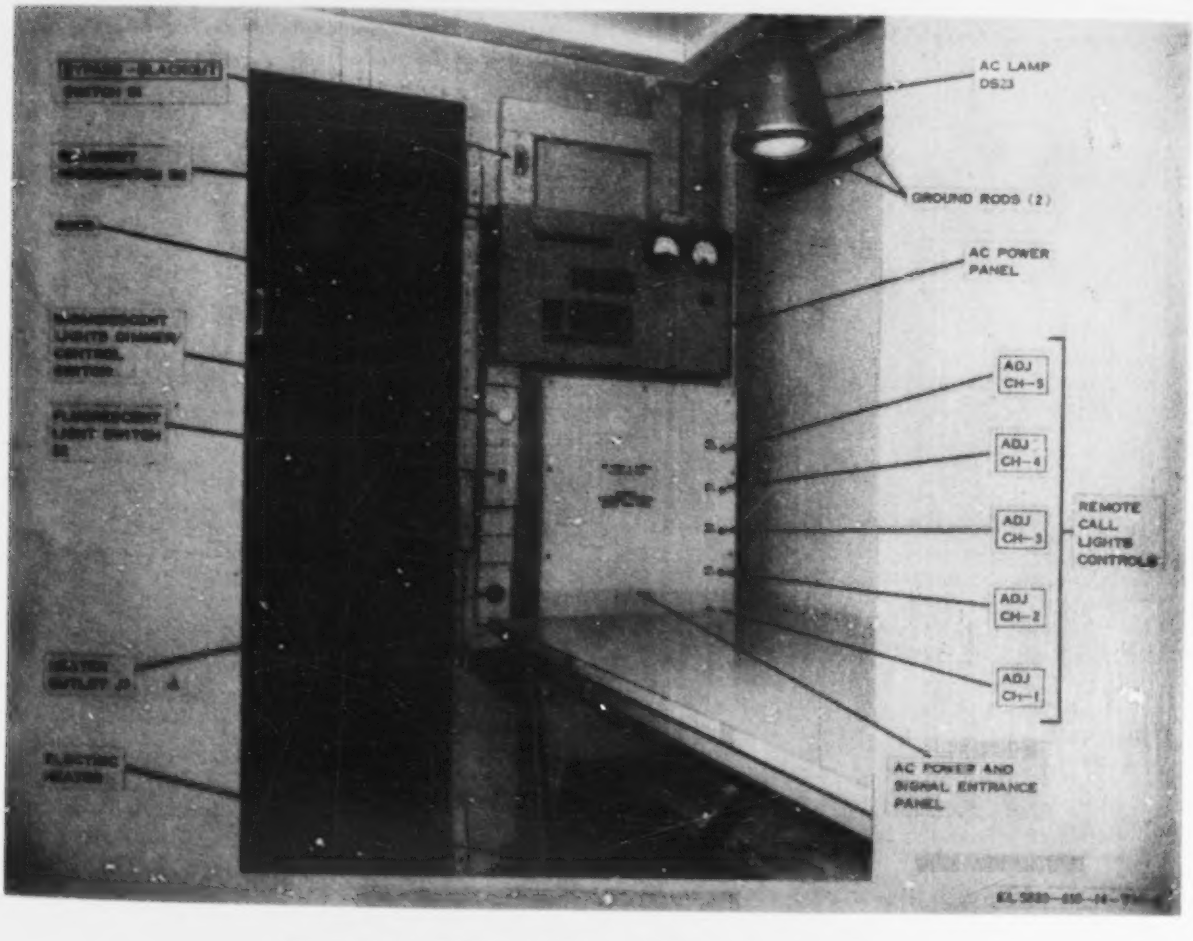

BYPASS – BLACKOUT SWITCH S1
DOOR
FLUORESCENT LIGHTS DIMMER/ CONTROL SWITCH
FLUORESCENT LIGHT SWITCH S1
HEATER OUTLET J
ELECTRIC HEATER
AC LAMP DS23
GROUND RODS (2)
AC POWER PANEL
ADJ CH-5
ADJ CH-4
ADJ CH-3
ADJ CH-2
ADJ CH-1
REMOTE CALL LIGHTS CONTROLS
AC POWER AND SIGNAL ENTRANCE PANEL
EL 5820-610-14-TM

Figure 1-12. AN/TRC-138A shelter interior, left lower corner view.

is located at the rear of the shelter, roadside of the door. This panel is used for connecting the 110-volt ac power from the power unit to the shelter, for connecting the remote control console to the shelter using the remote signal cables, and provides a GROUND TERMINAL lug for grounding the shelter. A dc power and signal entrance panel (A fig. 1-8) on the front of the shelter accomodates 28-volt dc input power from the carrying vehicle for mobile operation. Two ORDER WIRE binding posts permit connection of a telephone line from the shelter to the cab of the vehicle. An antenna entrance panel (B, fig. 1-8) on the front curbside wall facilitates rf cable connection from the shelter to the five doublet antennas.

g. Power Distribution Panel (Interior) (fig. 1-13). An ac power and signal entrance panel is located on the rear wall of the shelter. It contains all the circuit breakers which control ac power distribution within the shelter. Panel lamps (red) indicate which breakers are on. All ac power applied to the shelter is controlled by a MAIN (60-ampere) circuit breaker. A large red panel lamp lights up when primary power (110-volts ac) is applied to the shelter. A panel ammeter and voltmeter indicate the amount of current and voltage being supplied by the generator.

h. Equipment Arrangement and Mounting (fig. 1-6, 1-11).

(1) Transceivers are mounted on a shelf running across the front and along the curbside of the shelter. The associated station controls, mounted on a second shelf above the transceivers, provide convenience of operation at each position.

(2) Most radio equipment in the shelter is mounted on suitable shock and vibration isolators. The PP-4765/GRC-159(V)(516E-2), PP-4151/FRC-83 (516F-2), and C-6118/FRC-93 (312B-4) units are hard-mounted.

(3) Storage drawers (fig. 1-14) for cables, whip antenna masts, and other small items are located on the curbside wall of the shelter. A separate drawer is provided for storing the crystal unit packs.

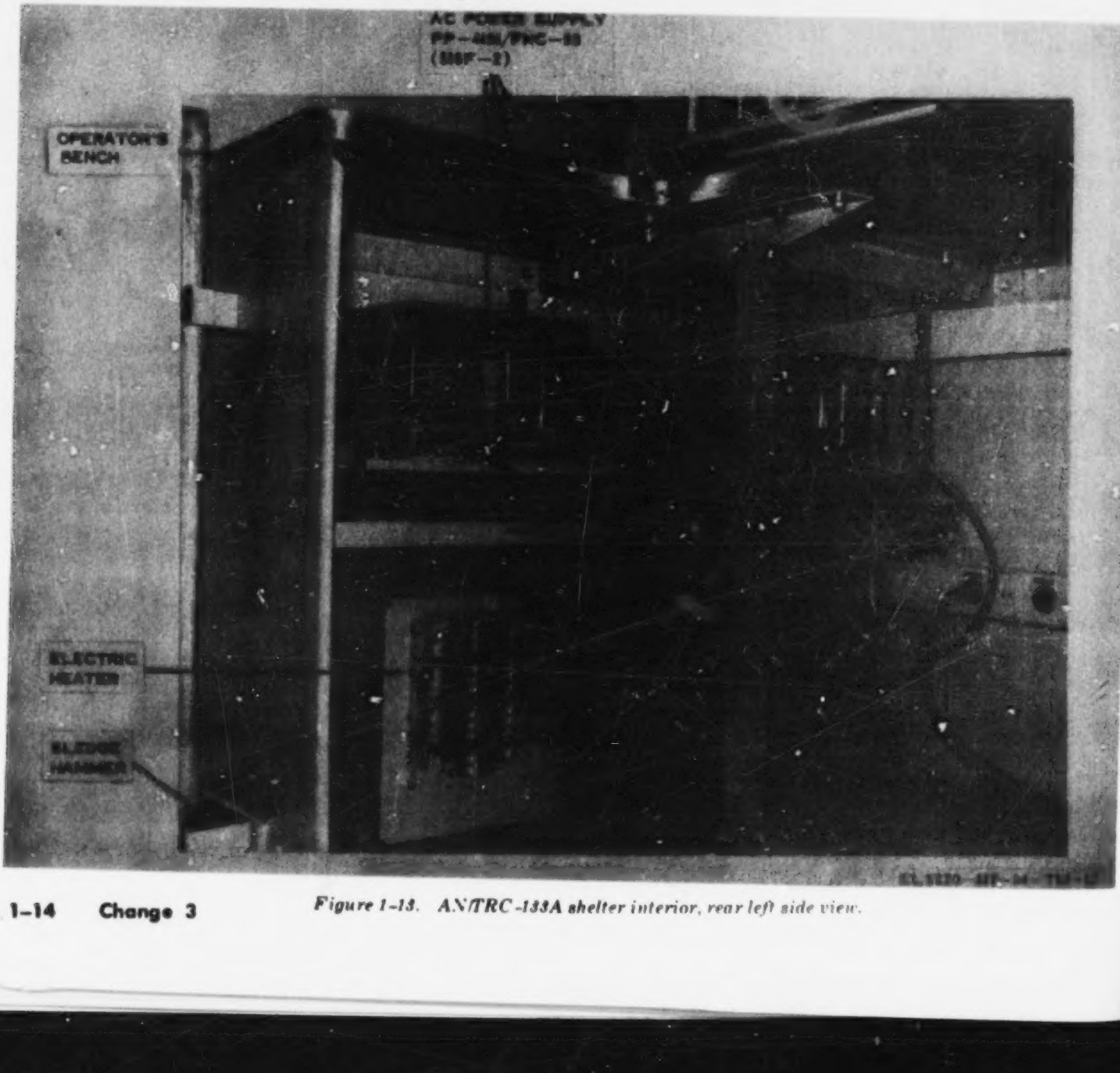


Figure 1-13. AN/TRC-133A shelter interior, rear left side view.

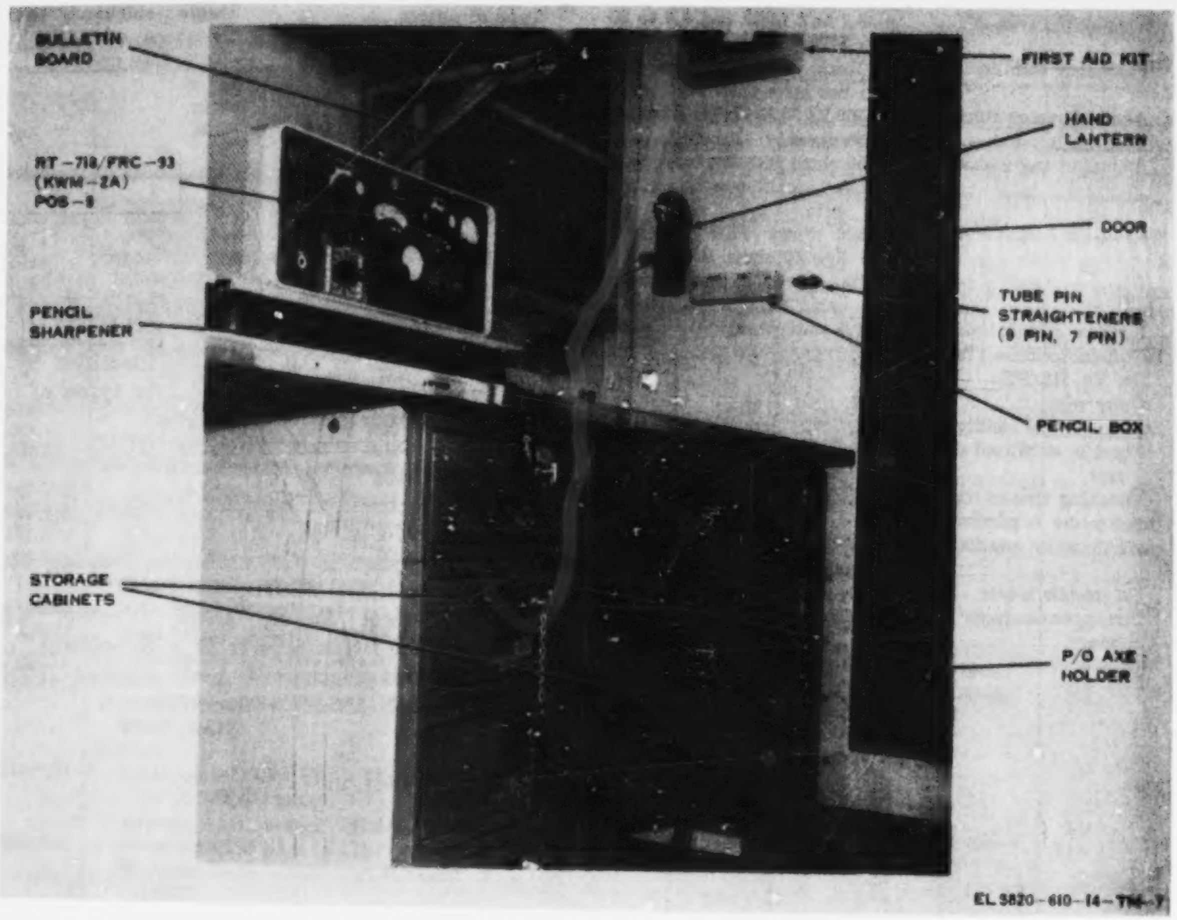


Figure 1-14. AN/TRC-133A shelter interior, rear right side view.

1-7. Description of Tuner, Radio Frequency TN-339/ GR

(fig. 1-10)

All controls and the meter are mounted on the front panel. Terminals located on the side and rear connect the unit to transceiver and to a whip antenna. Four spring clamps hold the tuner to the mounting base. The two TN-339/GR's are mounted on the top shelf in both corners of the front wall.

1-8. Description of Antennas

a. Whip Antenna. Each whip antenna consists of three Mast Sections MS-116-A, one Mast Section MS-117-A, and one Mast Section MS-118-A, which are assembled and inserted in Mast Base AB-652/GR. Mast Base AB-652/GR is mounted on Mast Bracket MP-49, which is secured to the front exterior wall of the shelter (fig. 1-1). The whips are tied down with insulated guy assemblies when the radio set is operated while in motion. When completely assembled, the whip antennas are 15 feet long.

b. Doublet Antennas. The components for nine masts (fig. 1-6) AB-155A/U, sufficient W-1 antennas wire, and the necessary associated hardware are furnished for the construction and erection of the half-wave doublet antennas. Three masts are required for support of each antenna at the lower operating frequencies, while only two masts are required at the higher operating frequencies. The rf signal cables provided permit siting of the doublet antennas at least 100 feet away from the shelter.

1-9. Technical Characteristics.

The technical characteristics of the AN/TRC-133A are listed below. The technical characteristics of individual components installed in the shelter are listed in the applicable publication for the component (app A).

Radio facilities:

Fixed or semifixed operating sets	5.
Mobile operating sets: (two of fixed sets above)	2.

Frequency range	3.4 to 5 MHz and 6.5 to 30 MHz.
Frequency stability	Total variation after warmup not more than 100 Hz.
Audiofrequency response	300 to 2400 Hz ± 6 db
Rf input impedance	50 ohms.
Rf output impedance	50 ohms with not more than 2.0 to 1 standing wave ratio.
Rf power output	100 watts PEP (nominal) into 50 ohms. 500 watts PEP (nominal) using linear amplifier.
Receiver output level	1.0 watt (max).
Telephone facilities (Telephone Set TA-312/PT):	
Order wire	2.
Remote control facility:	
Fixed or semifixed operating sets	5.
Matching speaker impedance	4 ohms.
Input power requirments:	
Ac (fixed or semifixed	60 amp, 110 volts, 60 MHz, single phase.
Dc (mobile mode)	24 amp, 28 volts (max).
Power consumption from ac line	235 watts in receive function (for each transceiver). 475 watts in transmit function (for each transceiver). 1725 watts required for RF Amplifier AM-3979/FRC-93.
Type of service	Single sideband (either sideband selectable); cw-50% duty cycle.
Shelter dimensions:	
Length	147 in.
Width	87 in.
Height	83 in.

1-10. Items Comprising an Operable Equipment

a. Identifying Items in Shelter. Lists of items that comprise an operable equipment in the AN/TRC-133A are given in *a* through *f* below. These lists contain four different kinds of identifying number systems. Some of the items are identified by one system, some by another. The four types of numbering systems are:

(1) Federal Stock Number (FSN)—example: 5820-464-1616.

(2) Electronics Command Drawing Number—example: SC-C-49686.

(3) Tobyhanna Army Depot Drawing Number—example: D1-10890B, A1-10607D.

(4) Federal Supply Code Number, which identifies the manufacturer of a component, used with the manufacturer's part number (P/N)—example: P/N 426-5076-00 (13499).

b. Major Items and Assemblies.

FSN	Item	Quantity	Dimensions (in.) Height	Dimensions (in.) Depth	Dimensions (in.) Width	Weight (lb)
NSN	AC POWER DISTRIBUTION PANEL, A1-10855D (14850)	1	12	5⅛	19½	30
NSN	Ac power and signal entrance box, A1-10584D (14850)	1	20	7	16½	20
NSN	Antenna components consisting of:					
NSN	Antenna kit:					
NSN	Electrical connector plug 102 (83330)	50				
NSN	Insulator assemblies 81143NL422B64-016 (modified) (14850)	50				
NSN	Insulator assemblies 81143NL422B64-016 (modified w/ring) (14850)	15				
NSN	Antenna entrance box, A1-10564D (14850):					
5935-197-4319	Jack, tip (83330)	50				
5340-545-4754	Snap, hook: 5336-7-16 (76786)	10				
5940-577-7076	Splice conductor: KS90 (09922)	100				
6145-128-8695	Electrical wire: QQ-W-343, Type C, Class B (81348) 2000 ft.					
5985-507-6261	Mast AB-155/U (80058)	9	5¾	7¼	66L	55
5820-199-8831	Mast Section MS-116A (80063)	8	⅛	⅛	39½L	1
5985-00-115-7149	Mast Section MS-117A (80063)	4	⅛	⅛	39½L	1
5985-00-238-7474	Mast Section MS-118A (80063)	4	⅛	⅛	39½L	1
	Blower assembly, 9 o'clock blast, cw rotation A-539897 (14850)	1				
	Cables:					
5995-926-7831	Cable Assembly, AC Power Electrical (100 ft lg) CX-7453A/U (80058)	1				
NSN	Antenna Feed Assembly WDS-540D (14850)	5				
5995-935-2686	Power electrical (15 ft lg) CX-7705/U (80058)	1				
	Dc Power, Electrical (21 ft lg) WD-536D (14850)	1				
	Special Purpose: Remote Control Console (500 ft lg) WD-536D (14850)	1				
	Special Purpose, Remote Control, Extending (500 ft lg) WD-562D (14850)	2				
	RF-1 cable assy (various lengths), RG-8A/U, PL-259A (14850)	8				
	RF-2 cable assy (various lengths), RG-8A/U, UG-21E (14850)	2				
	RF-3 cable assy (various lengths), RG-8A/U, UG-21E, one end PL-259A/U other end (14850)	15				
	Antenna cable assembly extension A1-12766D (14850)	25				
8130-656-1090	Cable Reel RG-435/U (80058)	1				
8130-711-0537	Cable Reel RG-405/TR (80058)	4				
	Circulating fan; 24vdc, swivel base, type 18420-03 (46522)	1				
	Dc power distribution panel A1-10598D (14850)	1	7	4	12	15
6625-982-2238	Directional wattmeter, 302C3: 522-1696-00 (13499)	1	4	4	6¾	1¾
6625-177-1639	*Dummy Load, Electrical: DA-75	1	8½	6	19¼	21
6625-930-1810	Dummy Load, Electrical: DA-412/U (80058)	1	8½	5⅛	16¾	20
5820-034-4245	Dummy load, electrical, 100 W, DL-1 (13499)	1	3½	7¼	5⅛	10
	Equipment cooling fan: 3380 rpm, 115vac 270CFM: type 103 (82877)	1				
5965-669-9145	Handset H-60/PT (80058)	1				
4520-117-6198	Heater, electric: 1500 W: SC-D-539485 (80058)	2	12¼	7⅝	8½	18
	Power supply, 22-25vdc, 6 amp, RB 23-6.0 (23934)	1	6½	10½	5	10

*Dummy Load, Electrical DA-75 is issued with 10 of the early models of the AN/TRC-133A. In the later models, DA-214 replaces the DA-75

FSN	Item	Quantity	Dimensions (in.)			Weight (lb)
			Height	Depth	Width	
6130-926-7805	Power supply: 28vdc, 516E2: 522-0984-005 (13499)	2	7¾	5¾	11⅜	12½
5820-681-9667	Radio Frequency Tuner TN-339/GR (80058)	2	14½	23½	11¼	48
5820-082-4276	Radio Set AN/FRC-93, consisting of	5				
5995-740-0786	Crystal Unit Set, Quartz CK-31/FRC-93 (80058)	5	(in drawers, 126 crystals in each case)			
5965-034-4249	Microphone, Dynamic M-127/FRC-93 (80058)	5	(cord 11" to 5' stretched)			
5820-034-4239	Power Supply PP-4151/FRC-93 (80058)	5	7¾	9⅛	11½	30
5820-082-4081	Radio Frequency Amplifier AM-3979/FRC-93 (80058)	1	6⁹⁄₁₆	13¾	14¾	38
5820-082-4082	Radio Set Control C-6118/FRC-93 (80058)	5	7½	11¾	10¾	8½
5820-082-4080	Receiver-Transmitter RT-718/FRC-93 (80058)	5	7¾	14	14¾	18⁹⁄₁₆
	Remote Control Console: (WD3-532F) (14850)	1	8	12¾	28	12
	Rf amplifier input selector A1-10857B (14850)	1	7½	6¾	7¾	12
	Rf switching relay box A1-10607D (14850)	1	3½	5½	6¼	5
5805-543-0012	Telephone Set TA-312/PT (80058)	2	7¾	5	15	9¾
	Whip antenna switch A1-10602D (14850)	2	5½	11	6¼	10
	110VAC-28VDC selector switch A1-10611D (14850)	2	4½	7	5½	5

c. Miscellaneous Items Installed in Shelter.

FSN	Item	Quantity
NSN	Adapter, uhf to PHONO DOW Key DK-210 (00471)	1
NSN	Air cooling duct extension A1-10576D (14850)	1
NSN	Amphenal coaxial plug P/N 82-835 (02660)	1
NSN	Antenna feedthrough insulator D1-10890B (14850)	2
NSN	Antenna feedthrough stud 3/8-16 D1-10890B (14850)	2
NSN	Banana jack w/braid 3 in. A1-12770C (14850)	50
NSN	Bananna plug w/braid 3 in. A1-12771C (14850)	50
NSN	Cabinet drawer, Lyons Metal Product P/N 2788	9
NSN	Coaxial plug UG-21D/U Collins P/N 357-9261-00 (13499)	1
NSN	Dc power supply mounting bracket DI-10557C (14850)	1
5120-596-4303	Dual pin straightener: D279SP (88065)	1
NSN	Duct extension assembly A1-10577D (14850)	5
NSN	Duct fan holddown TAB DI-10858D (14850)	3
NSN	Fan, Rotron P/N 14559 (82877)	1
4210-270-4512	Fire extinguisher, 5 lb	1
6545-922-1200	First aid kit	1
NSN	First aid kit bracket assembly SC-C-539463 (80063)	1
5975-224-5260	Ground Rods MX-148/G (80058)	2
NSN	Interior antenna feedthrough insulator cap D1-10886C (14850)	2
6210-752-2543	Lampholder, Swivelier P/N 825-0115 (08621)	3
NSN	Lantern bracket assembly SC-C-539428 (80063)	1
NSN	Linear amplifier bracket assembly A1-10572 GR III (14850)	2
NSN	Linear coupler bracket D1-10885B (14850)	1
5985-497-8704	Mast base bracket MP-49 (80058)	2
NSN	Microphone clip holders	5
NSN	Modified clock assembly D1-10882B (14850)	1
NSN	Pencil box SC-D-539455 (80063)	1
7520-162-6178	Pencil sharpener	1
NSN	Rim mount guard, Rotrun P/N 14559 (82877)	1
NSN	Rubber mat SC-C-539500-1 (88063)	1
NSN	Rubber washer SC-B-49699 (80063)	4
NSN	Shock isolator for linear amplifier #2K1-BA-10	4

FSN	*Item*	*Quantity*
NSN	Shock isolator A1-10533D-1 (14850)	8
NSN	Station control mounting bracket 312B-4, D1-10555C (14850)	10
NSN	Support channel D1-10558C for TN-339/GR (14850)	4
NSN	Telephone bracket assembly for TA-312/PT, SC-D-539506 (80063)	1
NSN	Transceiver (KWM-2A) bracket assembly A1-10572-C (14850) GR I	10
NSN	Wattmeter bracket assembly A1-10861D	1
6645-950-8599	*8-day clock	1
6240-233-3457	30V, 100-watt bulb	1
NSN	115-vac power supply bracket assembly A1-10572 GR II (14850)	2
6240-246-5052	120V, 100-watt bulb	3

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*Some models of this equipment are provided with clock, 8-day, NSN 6645-00-970-0177. Either clock is valid for this equipment.

d. Miscellaneous Items Packed in Shelter.

FSN	Item	Quantity
NSN	Ac power plug adapter, Collins P/N 368-0138-00	
9920-682-6757	Aluminum ash tray	1
NSN	Antenna storage cover assembly A1-10560D (14850)	2
5985-228-8064	Antenna, Tiedown MX-516/GRA-4 (80058)	1
NSN	Cable assembly, Collins P/N 426-2027-00 (13499)	2
NSN	Cable assembly, Collins P/N 426-5076-00 (13499)	2
NSN	Cable assembly, high voltage antenna, WD 3-563C (14850) GR II	1
5910-160-0395	Capacitor	2
or		1
5910-574-8160		
or		
5910-925-3611		
7210-753-3043	Chair cushion	
7520-281-5918	Clip board, 8" x 12-½"	1
4940-752-2525	Electrical grounding lead, 10 ft.	1
5995-052-7414	Extension Cord CD-307, 4 ft lg	2
NSN	Fire axe, SC-C-539451 (80058)	5
6240-152-2996	Fluorescent lamps	1
6250-194-4794	Fluorescent starters	7
7105-269-8463	Folding chair	7
NSN	Fuse, 8-ampere, Collins P/N 264-4110-00 (13499)	1
NSN	Ground strap assembly, 8 in. lg, WD3-564C GRI	6
NSN	Ground strap assembly, 15 in. lg, WD 3-564C GR II	2
NSN	Ground strap assembly 18 in. lg, WD 3-564C GR III	5
NSN	Insulator SC-C-49686 (80063)	1
NSN	Insulator SC-C-49687 (80063)	2
7920-178-8315	Hand brush	2
2230-729-9614	Hand lantern	1
5965-669-9145	Headset H-60/U modified W/U-77/U connector (80058)	1
6240-155-7836	Lamp bulb #327	1
6320-239-3518	Light extension, 25 ft.	11
NSN	Lightweight ladder with handrail A1-10868D (14850)	1
6605-264-3994	Magnetic compass	1
NSN	Modified cable reel holder assembly A1-10876C (14850)	1
6240-892-4420	Neon bulb NE-2D	1
6240-179-1812	Neon bulb NE-48	5
6240-223-9100	Neon bulb NE-51	1
5340-802-7406	Padlock and keys, SC-C-595537	14
7110-273-8791	Rotary chair	1
NSN	Safety model belt, FDC 2475-1	2
5120-234-8910	Screwdriver, 6"	1
5120-900-6096	Sledge hammer	1
5410-805-5583	Sling assembly	1
5410-792-6336	Tiedown straps	1
7520-753-4807	Waste basket	2
5120-787-8977	Wrench, Bristo #6	1
5120-223-6995	Wrench, Bristo #8	1
NSN	Wrench set, VACO 516014	1
7910-832-7222	Vacuum cleaner, Hoover Pixie Model 2820	1
		1

e. Manuals Packed in Shelter.

(1) TM 11-809-10, Operator's Manual, Radio Transmitters T-368/URT, T-368A/URT, B, C, D, & E. Antenna Tuning Unit BC-939B, Radio Frequency Tuner TN-339/GR, and Standing Wave Ratio-Power Meter ME-165/G.

(2) TM 11-5820-532-15, Organizational, DS, GS, and Depot Maintenance Manual, Amplifier RF, AM-3979/FRC-93 (Collins Model 30L-1) Including Repair Parts and Special Tool Lists.

(3) TM 11-5820-610-14, Operator's, Organizational, Direct Support, and General Support Maintenance Manual, (Including Repair Parts and Special Tools List) Radio Terminal Set AN/TRC-133( ).

(4) Instruction Manual, Collins P/N 523-0122-00, Covering Collins Linear Amplifier 30L-1.

(5) Log Book, Collins P/N 523-0755-820.

1-11. Expendable Consumable Supplies and Material

The supplies and materials listed below are required for operation of this equipment and are authorized to be requisitioned by SB 700-50. The FSN for the applicable unit of issue required can be found in appropriate supply catalogs. The FSCM is used as an element in item identification to designate manufacturer or distributor or Government Agency, etc., and is identified in SB 708-42.

Item	Description	Ref No. and FSCM	FSC
1	Pad, writing paper, yellow 8 in. x 12-½ in.	SS-P-196A 81349	7530
2	Pencil, china, marking, red color.	SS-P-196R 81349	7510
3	Pencil, china, marking, black color.	SS-P-196B 81349	7510

CHAPTER 2

INSTALLATION

2-1. Unpacking and Checking

a. Packaging Data. The AN/TRC-133A is packed in a reusable wooden crate. The S-280A shelter, which houses the equipment, is anchored to eyebolts in the skid base of the crate and is blocked at the sides and ends with lumber. The skid base has entries for handling with a forklift. The dimensions of the crate are 167 inches long, 103 inches wide, and 95 inches high. The volume is 946 cubic feet, and the weight of the crated AN/TRC-133A is approximately 5,000 pounds.

CAUTION

Do not thrust any tools into the interior of any pack or package.

b. Removal of Contents (fig. 2-1).

(1) Unfasten the lag bolts with wrenches, and remove the top, front, rear, and side panels from the crate base.

(2) Detach the tiedowns from the eyebolts in the base of the crate. When cable or tiedown rods are used for anchoring, loosen the turnbuckles.

(3) Remove the wood blocking from the sides and ends of the assemblage.

CAUTION

Be careful when handling tools, because the aluminum skin of the S-280A/G shelter can be easily damaged.

(4) Remove the assemblage from the crate base. Use overhead lifting equipment whenever available; if it is not available, remove the headers from the crate base, lift the shelter from either side with a forklift, using the two holes in each skid labeled "forklift here." If a forklift is not available, drag the assemblage from the crate base by the towing eyes.

(5) Send the crate to a local storage area, if practical for reuse.

c. Checking Assemblage Contents. Check the contents of the assemblage against the packing list. If the packing list is not available, use the list entitled "Items Comprising an Operable Equipment" (para 1-10).

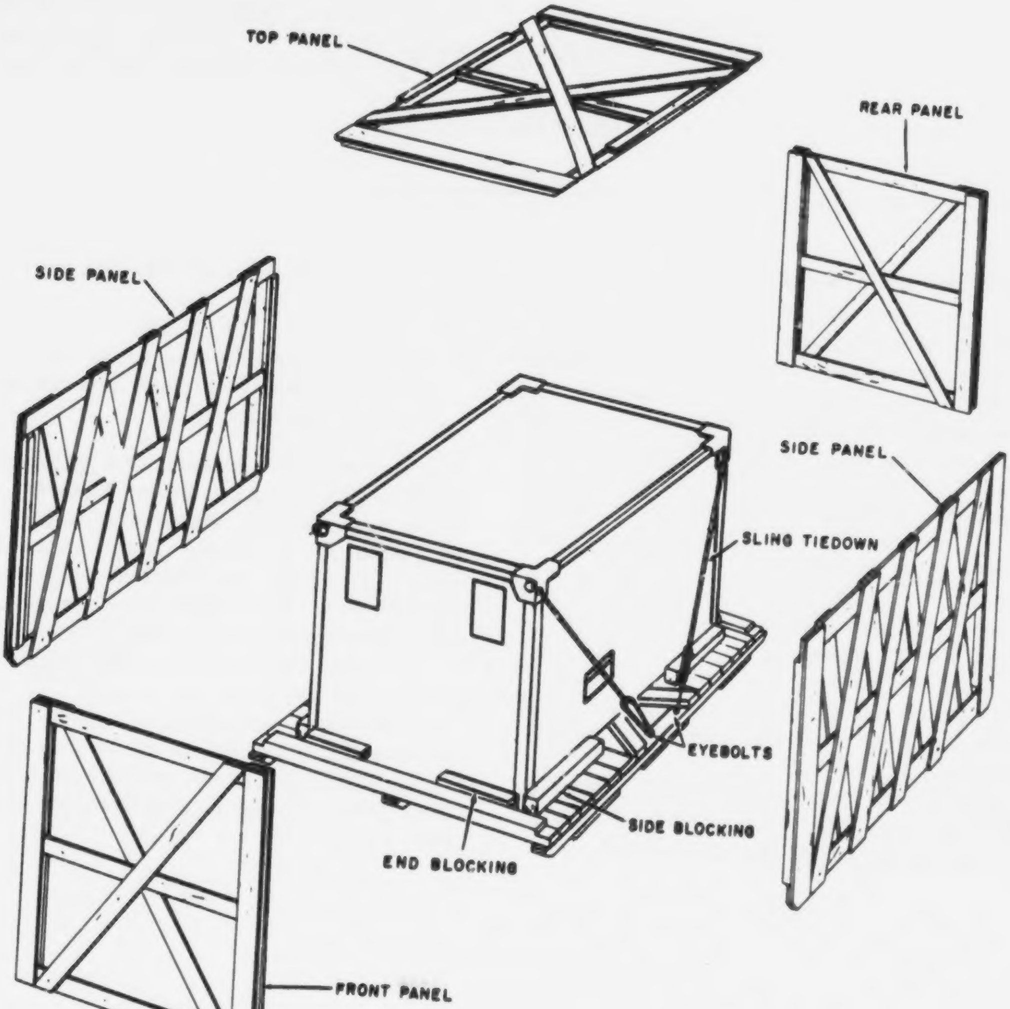


Figure 2-1. Removal of contents.

2-2. Checking Unpacked Equipment

a. Inspect the equipment for damage incurred during shipment. If the equipment has been damaged, report the damage on DD Form 6 (para 1-3).

b. Check the equipment against the component listing and the packing slip to see if the shipment is complete. Report all discrepancies in accordance with paragraph 1-3. The equipment should be placed in service even though a minor assembly or part that does not affect proper functioning is missing.

c. Check to see whether the equipment has been modified. (Equipment which has been modified will have the MWO number on the front panel, near the nomenclature plate.) Check also to see whether all currently applicable MWO's have been applied. (Current MWO's applicable to the equipment are listed in DA Pam 310-7.)

2-3. Siting

a. Location of the radio shelter will depend on the tactical situation and use of the shelter in its assigned area. When installed on the ground for fixed or semifixed operation, the shelter should be located on firm, dry ground which has sufficient drainage. The site should be cleared and leveled. Whenever possible, concrete blocks or wooden boxes should be used as a foundation, and the shelter positioned to facilitate connections to the ac power and signal entrance panel. If the shelter is to remain truck-mounted, remove the ladder from the shelter. Install the handrail on the ladder and securely fasten the ladder to the truck body or frame.

b. When ac generators are used as the power source, position the shelter approximately 75 to 100 feet away from the power source to minimize generator noise interference.

2-4. Installation of Shelter

CAUTION

Be sure no hardware projects from the shelter during unloading or loading operation. Damage to the shelter may result. Close and secure all shelter vents; disconnect all rf connections to doublet antennas. Disconnect all ac or dc power cables, ground braids, and order-wire lines to the truck cab.

a. Unloading Shelter From Truck.

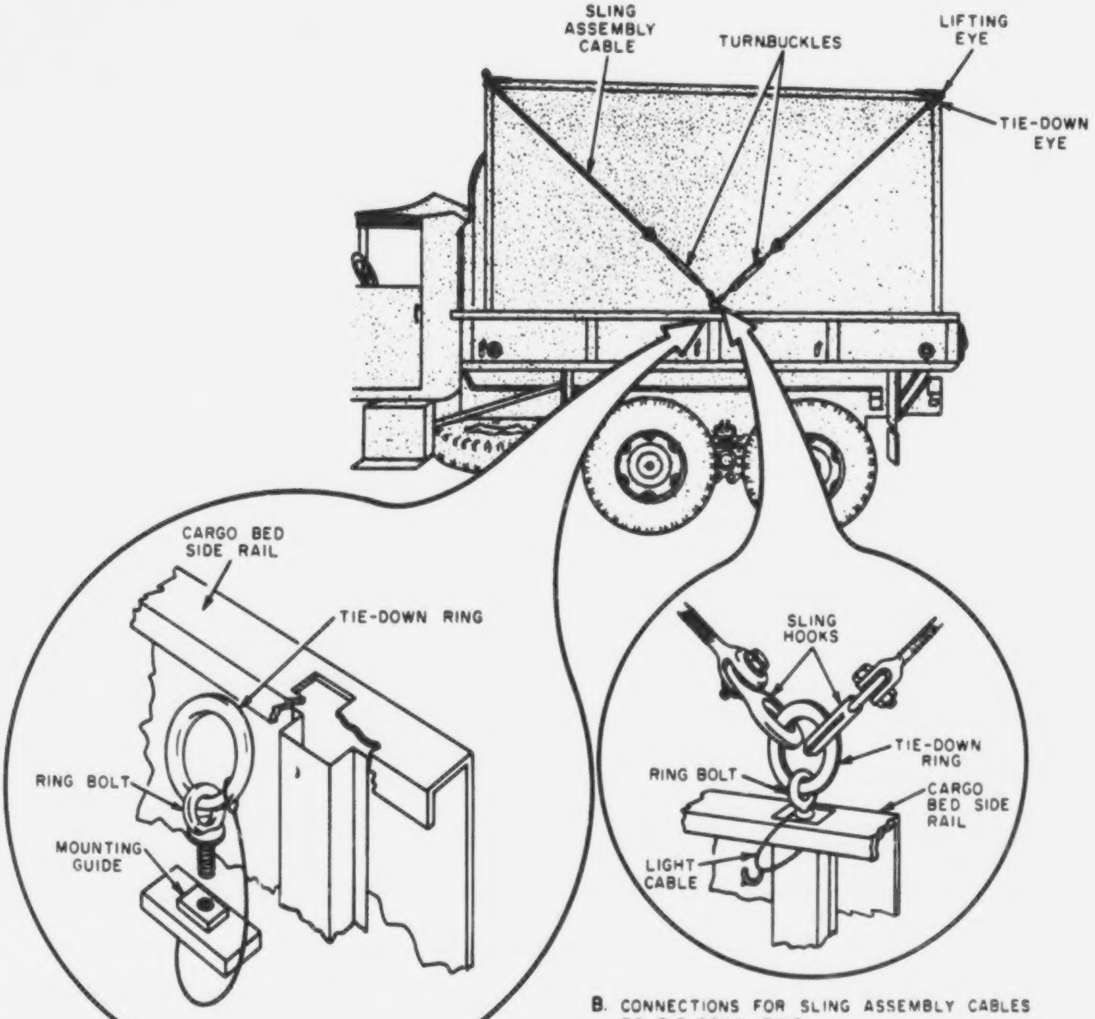
(1) Lower the truck tailgate.

(2) Release the locknuts that secure the sling assembly turnbuckles (fig. 2-2) in place, and loosen the turnbuckles.

(3) Remove the sling assembly hooks closest to the turnbuckles from the tiedown ring assemblies.

(4) Remove the sling assembly hooks farthest from the turnbuckles from the shelter tiedown eyes.

(5) Remove the tiedown ring assemblies (A, fig. 2-2) from the center of each cargo-bed side rail.


SLING ASSEMBLY CABLE
TURNBUCKLES
LIFTING EYE
TIE-DOWN EYE
CARGO BED SIDE RAIL
TIE-DOWN RING
RING BOLT
MOUNTING GUIDE
SLING HOOKS
TIE-DOWN RING
RING BOLT
CARGO BED SIDE RAIL
LIGHT CABLE

B. CONNECTIONS FOR SLING ASSEMBLY CABLES TO TIE-DOWN RING.

A. EXPLODED VIEW OF TIE-DOWN RING ASSEMBLY.

EL5820-610-14-TM-12

Figure 2-2. Shelter tiedown.

b. Lifting Shelter (fig. 2-2, 2-3).

NOTE

Some shelters have both a lifting eye and tiedown eye. Other shelters have a single eye which serves as both a lifting eye and tiedown eye.

CAUTION

If the shelter to be moved has two eyes at each upper corner, be sure that the sling assembly hooks are connected to the lifting eyes; damage to the shelter may result if the tiedown eyes are used for lifting. Use tiedown eyes for tiedown only.

(1) Connect the sling assembly center hooks (nearest the turnbuckles) to the shelter lifting eyes.

(2) Place the remaining end of the sling assembly on the shelter roof.

(3) Connect the four sling assembly hooks to a lifting ring.

(4) Place the lifting ring over the hook of a lifting device.

WARNING

To avoid injury to personnel and damage to the equipment, only personnel engaged in the actual lifting operation should be near the lifting device and shelter. To eliminate confusion, all instructions must come from the lifting crew supervisor.

(5) Tie a guide rope, one-half inch in diameter and a minimum of 15 feet long, to each rear towing eye of the shelter.

CAUTION

Observe the following cautions to avoid damage to the shelter.

1. Lift the shelter *slowly*.
2. Avoid sideways swinging of the shelter.
3. Do not bounce or jar the shelter when it is supported by the lifting eyes.
4. Do not butt the shelter into place with forklifts or similar moving equipment.

(6) Lift the shelter smoothly with a lifting device such as a crane or an M-58 boom. Do not lift the shelter to unnecessary heights during removal from the truck.

(7) Lower the shelter slowly to the desired foundation.

(8) Remove the sling assembly and store it with the shelter.

(9) When it is desired to relocate the shelter, follow the procedure outlined in *c* below.

c. Securing Shelter to Truck (fig. 2-2).

(1) Install the tiedown ring assembly (A, fig. 2-2) above the center support of each of the truck cargo-bed siderails.

(2) Lift the shelter from its foundation by following the procedures given in *b*(1) through (6) above.

(3) Lower the truck tailgate, back the truck under the shelter, and lower the shelter into the body of the truck, positioning the front of the shelter against the front of the truck body.

(4) Block the shelter in accordance with TB 750-240.

(5) Secure the sling assembly hooks farthest away from the turnbuckles to each of the four shelter tiedown eyes.

(6) Secure the sling assembly hooks closest to the turnbuckles to the tiedown ring assemblies ((1) above).

CAUTION

Do *not* tighten turnbuckles unevenly or excessively. Damage to the shelter may result.

(7) Evenly tighten the four turnbuckles as tight as possible by hand.

(8) Insert a bar or rod in the turnbuckles and turn each turnbuckle one additional half-turn.

(9) Raise and secure the truck tailgate.

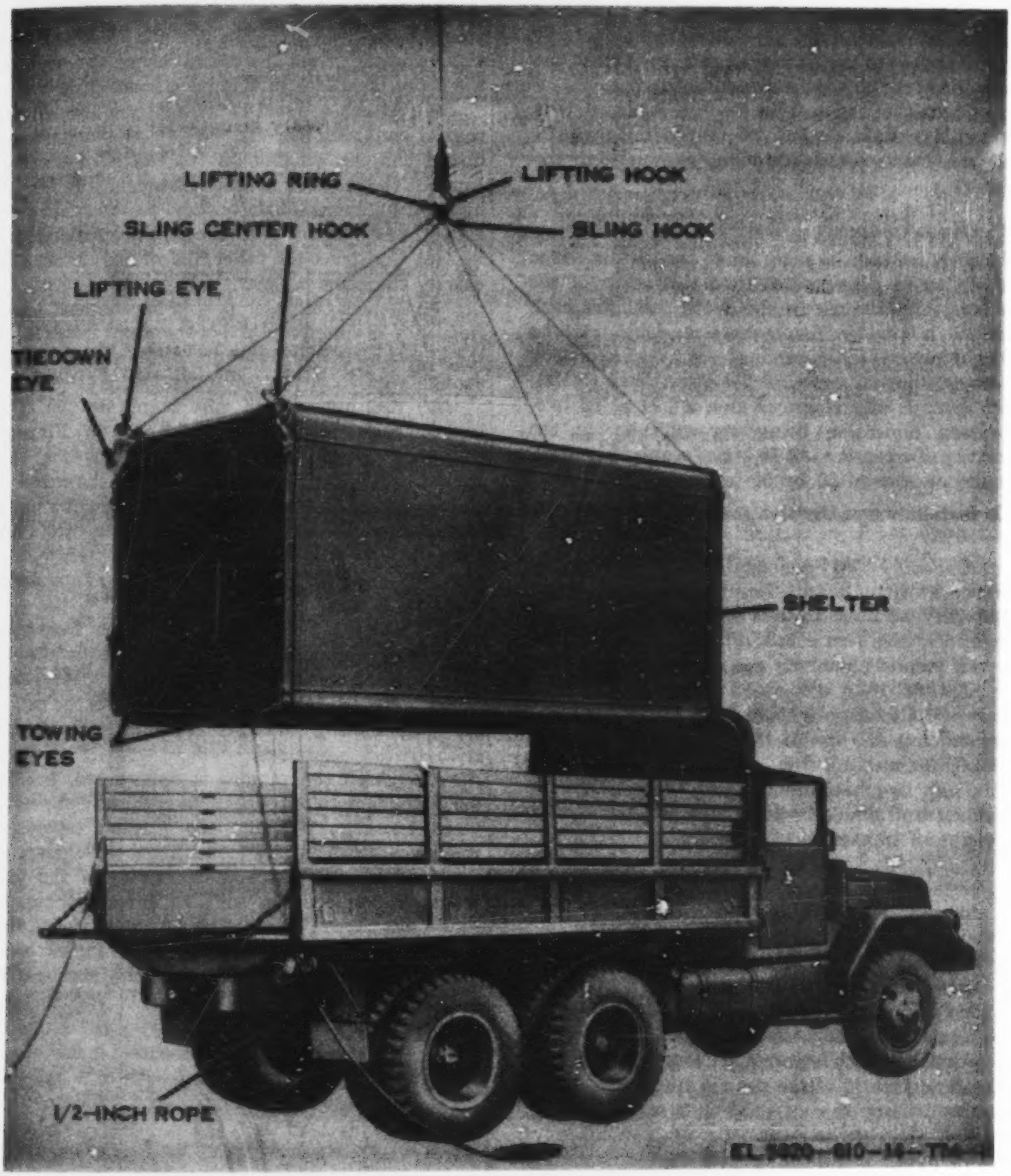

LIFTING RING
LIFTING HOOK
SLING CENTER HOOK
SLING HOOK
LIFTING EYE
TIEDOWN EYE
SHELTER
TOWING EYES
1/2-INCH ROPE
EL 5820—610—14—TM

Figure 2-3. Mounting shelter on truck.

2-5. Installation of Whip Antenna

a. Check to see that the antenna mounting bracket and mast base have been installed on the shelter (A, fig. 1-1).

b. Assemble the whip antenna as follows:

(1) Screw three Mast Sections MS-116-A together; tighten the connections.

(2) Screw one Mast Section MS-117-A into a Mast Section MS-118-A and tighten the connection.

(3) Screw the two assembled mast sections together. Be sure that connection is tight.

(4) Screw the assembled mast sections into Mast Base AB-652/GR.

(5) If the radio set is to be operated while in

motion, bend the antenna backward to a horizontal position and attach the whip antenna holddown guy rope to the top of the MS-117-A section. Attach the other end of the guy to a shelter tiedown ring.

c. Check that the antenna lead-in (A, fig. 1-1) is connected between the base of AB-652/GR (app. C) and the insulated feedthrough terminal on the shelter.

2-6. Doublet Antennas, General

The length of coaxial cable limits the distance that the shelter may be located from the center of the transmitting antenna to about 150 feet. For each antenna, it is desirable to have a clear, level area, the size of which is determined by the operating frequency. *For example,* at 3.4 MegaHertz (MHz), each antenna will require an area of 190 by 50 feet, the long dimension being perpendicular to the direction of reception. At 18 MHz, each antenna will require an area of 80 by 50 feet.

2-7. Installation of Doublet Anennas and Mast AB-155A/ U.

a. General. The doublet antenna equipment furnished with Radio Terminal Set AN/TRC-133A may be used instead of the whip antennas when operating from a fixed or semifixed location to provide greater directivity and signal pickup. When the AN/TRC-133A is operated within the frequency range of 1.5 to 4.0 MHz, the length of the antenna wire requires the use of three 40-foot Masts AB-155A/U for each antenna. At frequencies above 4.0 MHz, only two masts are required for each antenna. Each antenna should be positioned broadside to the direction of transmission or reception.

NOTE

Since only nine masts are supplied, additional masts must be obtained for operating all five sets simultaneously. For a frequency below 6 MHz, 6 additional masts are required. For a frequency above 6 MHz, one additional mast is required.

b. Antenna Construction. The antenna is a half-wave doublet which is normally operated at the half-wave fundamental of the desired frequency. If the antenna is to operate on more than one frequency, the radiating portion may be of a number of predetermined lengths of antenna wire separated by strain insulators and interconnected as required by jumpers. Construct the antenna as follows:

(1) List the operating frequencies.

(2) Refer to figure 2-4 and determine the overall antenna length for the fundamental frequency of each frequency assigned.

(3) Divide each overall antenna length ((2) above) by 2. This gives the antenna length of each side measuring from the coaxial connector. Include the strain insulator in this measurement.

(4) Attach one end of the antenna wire to the coaxial connector (B, fig. 2-5). Use a splice conductor and the wingnut on the coaxial connector. Run out the required length of antenna wire for the highest fundamental frequency to be used ((3) above), and connect it to the strain insulator.

(5) Construct the other half of the antenna in exactly the same manner.

(6) Attach the antenna wire for the next lower frequency to the unused end of the strain insulator of the antenna already constructed ((4) above). Allow enough wire for a jumper connection.

(7) Run out enough wire to obtain the total length required (difference between highest frequency length and length required) for this frequency ((3) above) as measured from the center of the coaxial connector to the end of the section being constructed. Connect the free end to a strain insulator.

(8) Construct the other half of the antenna in exactly the same manner.

(9) Construct each additional lower frequency antenna by adding more wire to the antenna already formed. Each antenna length should be measured from the center of the coaxial connector to the end of the antenna being constructed, including the length of the strain insulators.

(10) After the antenna is constructed, use the splice conductors to connect the required jumpers in place (A, fig. 2-5) for the primary operating frequency. Each antenna constructed will operate on the fundamental and odd harmonics of the fundamental frequency for which it is constructed. C, figure 2-5 shows an assembled antenna for 2,600, 2,750, 3,100, and 3.900 kHz. Figure 2-4 shows that a fundamental antenna for 2,600 kHz may also be used for 8,300, 13,800, or 19,400 kHz.

NOTE

The following formula may be used in lieu of figure 2-5 to compute the length of a half-wave antenna at the fundamental frequency:

$$\frac{L=468}{F}$$

Where L = Length in feet

F = Frequency in MegaHertz

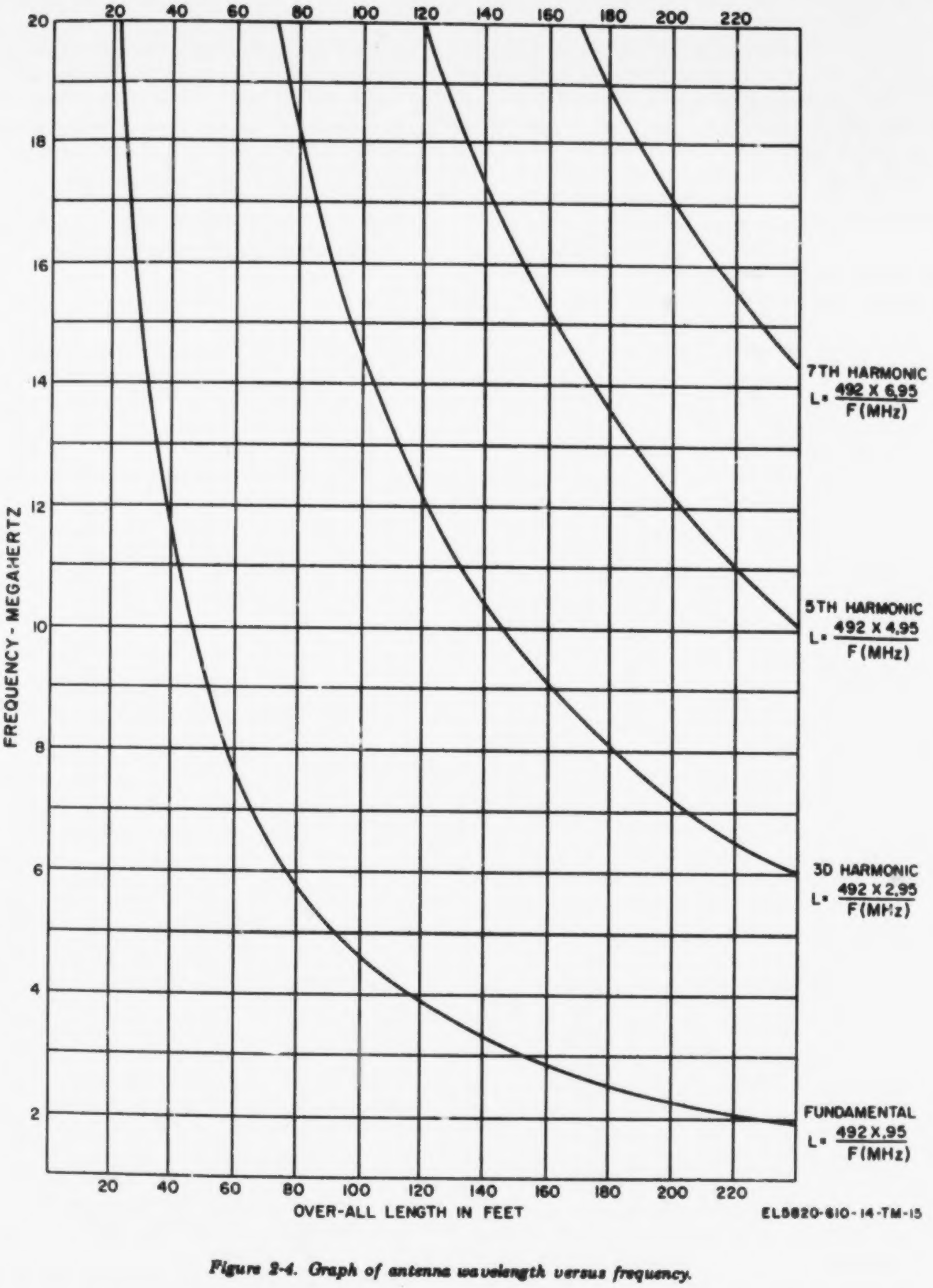


Figure 2-4. Graph of antenna wavelength versus frequency.

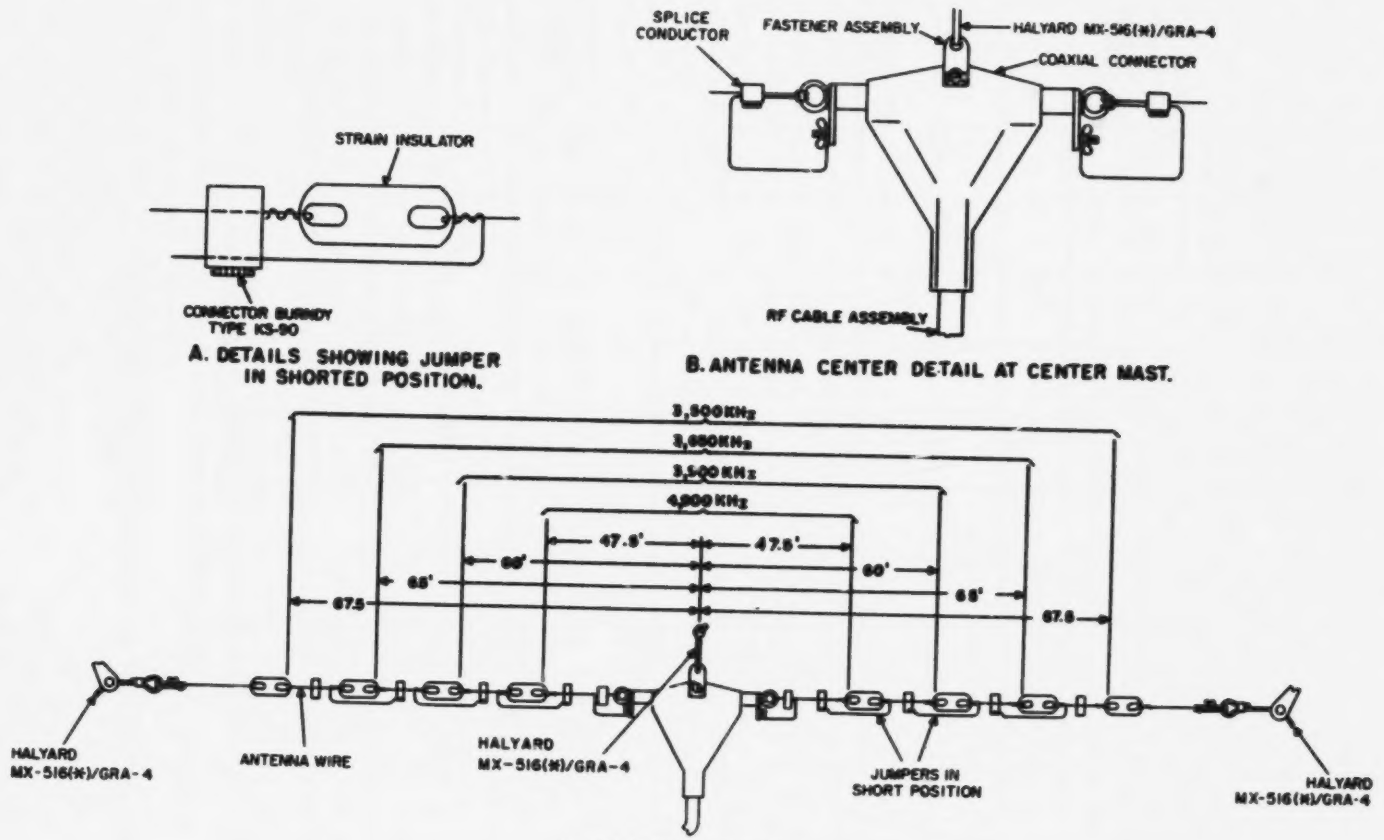

STRAIN INSULATOR
CONNECTOR BURNDY TYPE KS-90
A. DETAILS SHOWING JUMPER IN SHORTED POSITION.
SPLICE CONDUCTOR
FASTENER ASSEMBLY
HALYARD MX-516(*)/GRA-4
COAXIAL CONNECTOR
RF CABLE ASSEMBLY
B. ANTENNA CENTER DETAIL AT CENTER MAST.
3,500 KHz
3,600 KHz
3,900 KHz
4,900 KHz
47.5'
47.5'
60'
60'
65'
65'
67.5
67.5
HALYARD MX-516(*)/GRA-4
ANTENNA WIRE
HALYARD MX-516(*)/GRA-4
JUMPERS IN SHORT POSITION
HALYARD MX-516(*)/GRA-4
C. ASSEMBLED ANTENNA.
EL5820-610-14-TM-14

Figure 2-5. Construction and assembly of doublet antenna.

c. Mast AB-155A/U Erection. After the antenna has been constructed, determine the position for the antenna to be erected. A compass is required for accurate determination of antenna orientation. Stretch the assembled antenna along the ground in the desired position. Place the antenna in a position to allow proper connection of the antenna to the equipment in the shelter after it is raised. Plan to erect the end masts several feet beyond the end insulators. The center mast should be at the coaxial connector and offset 3 feet from the line of the antenna (fig. 2-6). A center mast will not be required if the overall antenna is less than 120 feet long. Erect each Mast AB-155A/U as follows:

(1) Place Mast AB-155A/U at each mast location and remove Cover CW-124/GRA-4 from Carrying Device MX-387/GRA-4 (fig. 2-7).

(2) Drive the stake of Mast Base AB-154/U into the ground at the desired mast location with the swivel end pointing 45 degrees from the line of the antenna (fig. 2-8). If the ground is soft or sandy, place the mast base plate (fig. 2-6) on the ground and push it down firmly; then drive the stake of MAST Base AB-154/U through the hole in the mast base plate.

(3) Assemble the mast as outlined in (*a*) through (*e*) below:

(*a*) Align the female ends of Mast Sections MS-44 (*) toward the mast base.

(*b*) Connect the first mast section (fig. 2-8) to Mast Base AB-154/U; add the second and third mast sections.

(*c*) Place a Guy Plate MX-378/U over the third section.

(*d*) Add the fourth and fifth sections; place a second MX-378/U over the fifth section.

(*e*) Add three more mast sections, and place a third MX-378/U over the last section.

(4) Position the guys stakes as outlined in (*a*) through (*e*) below:

(*a*) Slip a Guy Fastener MX-379/U over each guy stake before it is driven into the ground.

(*b*) Drive a guy stake (back guy stake) into the ground at the junction of the fifth and sixth MS-44 (*) (25 feet from Mast Base AB-154/U).

(*c*) Place the front and side guy stakes 90 degrees apart as shown in figure 2-8.

(*d* Use a guy rope to measure the distance between the mast base and the front and side guy stakes.

(*e*) If the ground is soft or sandy, use the wooden stakes instead of the aluminum stakes, and loop the guys over the stakes. Do not use the MX-379/U's.

(5) Fasten the guys as outlined in (*a*) through (*e*) below:

(a) Fasten four Guys MX-383(*)/GRA-4 to top Guy Plate MX-378/U, four Guys MX-381(*)/GRA-4 to center Guy Plate MX-378/U, and the remaining four Guys MX-382 (*) /GRA-4 to bottom Guy Plate MX-378/U.

(b) Fasten the guys by snapping the fastener at the end of each guy into one of the four holes located 90 degrees apart on the MX-378/U.

(c) Carry the free ends of the three back guys to a side guy stake to measure their correct length. Fasten these guys to the back guy stake with Guy Fastener MX-379/U.

(d) Connect both sets of side guys to their respective side guy stakes, and remove slack by adjusting Slide Fastener FT-9 (fig. 2-8). Do not overtighten because the mast may bend.

(e) Keep the three front guys together, and stretch them along the mast toward the front guy stake.

(6) Remove Halyard MX-516 (*) GRA-4 from the carrying device, and attach the snap fastener on the pulley to the unused hole in the top Guy Plate MX-378/U. Slip the rope through the pulley (fig. 2-6) and tie the ends of the rope near the mast base to keep the rope from running through the pulley when raising the mast.

(7) The mast is raised by three men as outlined in (a) through (c) below (fig. 2-9):

(a) Man number 1 holds the front guys and pulls steadily on them, keeping slightly more tension on the top guy to bow the mast slightly while being raised.

(b) Man number 2 takes a position near the mast base and holds Mast Base AB-154/U in the designated position as the mast is raised.

(c) Man number 3 stands near the top end of the mast and raises it as he walks toward the mast base.

(8) Adjust the guys until the mast is vertical. Whenever a guy is tightened, the opposite one may have to be loosened slightly to keep the mast from bowing.

d. Antenna Raising.

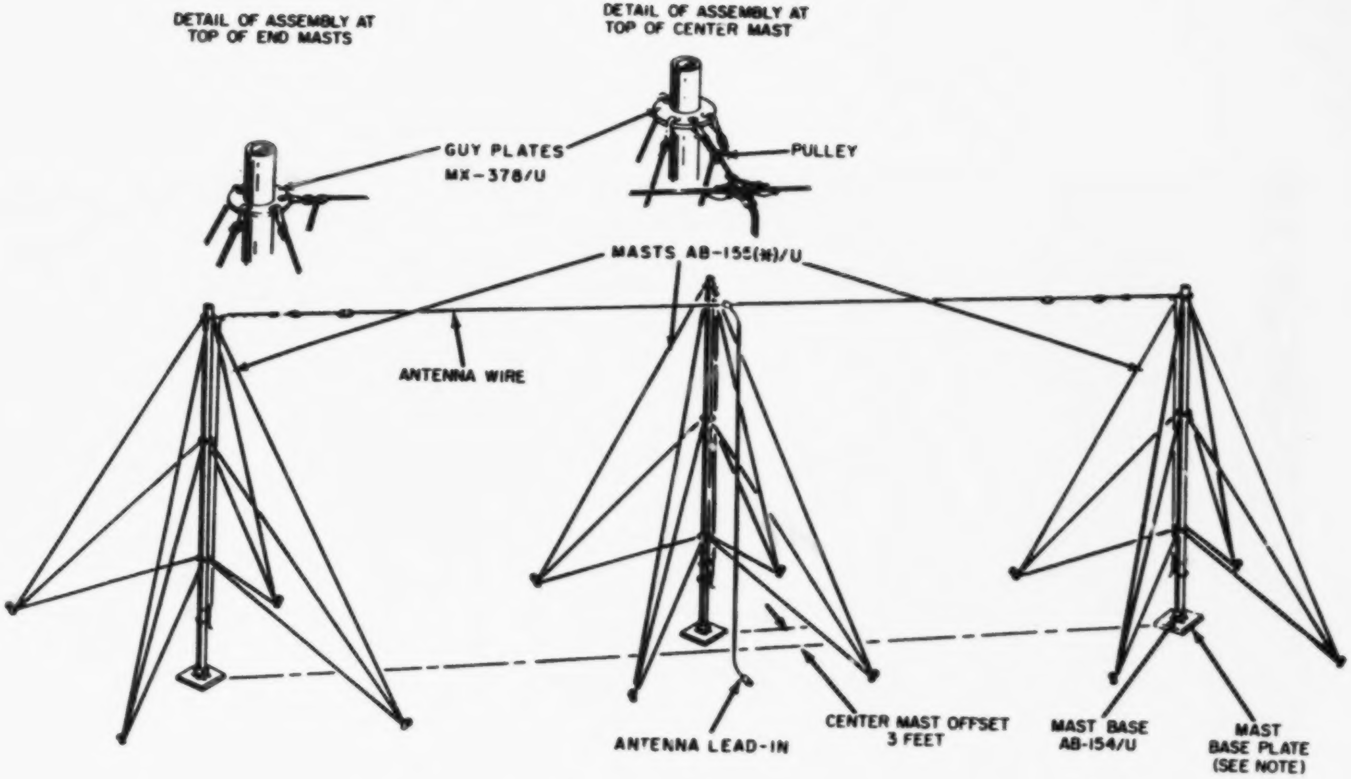
(1) If the center mast is used, attach the fastener on Halyard MX-516(*)/GRA-4 to the coaxial connector as shown in B, figure 2-5.

(2) Fasten Halyard MX-516(*) /GRA-4 on each end mast to the antenna wire by attaching one end of a wire (approximately 15 inches of Wire W-1) to the end strain insulator, and the other end to the fastener assembly on Halyard MX-516(*) /GRA-4.

(3) Pull the antenna wire into position with Halyards MX-516(*) /FRA-4. Tie the tope to the mast to prevent the weight of the antenna wire from pulling the loose end of the rope back through the pulley. Figure 2-6 shows a doublet antenna completely erected.

e. Antenna Connection. The antenna lead-in should be raised off the ground on poles if possible. In cold weather, raising the lead-in prevents the antenna lead-in from freezing to the ground and, at all times, minimizes damage which might result from lying on the ground. Connect the antenna lead-in connector to the antenna entrance panel connectors on the shelter (B, fig. 1-8). The antenna lead-in should be taped to both the mast and the shelter to relieve the tension on the coaxial connector.

f. Other Antenna Installations. If there is not enough time to erect the masts, construct a semifixed installation by using materials other than those supplied as a support for the antenna wire. Antenna supports can be improvised by using poles, trees, buildings, or other suitable supports whenever possible. The doublet antenna must always be insulated from its supports.


DETAIL OF ASSEMBLY AT TOP OF END MASTS
DETAIL OF ASSEMBLY AT TOP OF CENTER MAST
GUY PLATES MX-378/U
PULLEY
MASTS AB-155(*)/U
ANTENNA WIRE
ANTENNA LEAD-IN
CENTER MAST OFFSET 3 FEET
MAST BASE AB-154/U
MAST BASE PLATE (SEE NOTE)

NOTE:
THE MAST BASE PLATE IS
USED ONLY WHEN GROUND
IS SOFT OR SANDY.

EL5820-610-14-TM-18

Figure 2-6. Doublet antenna erected.

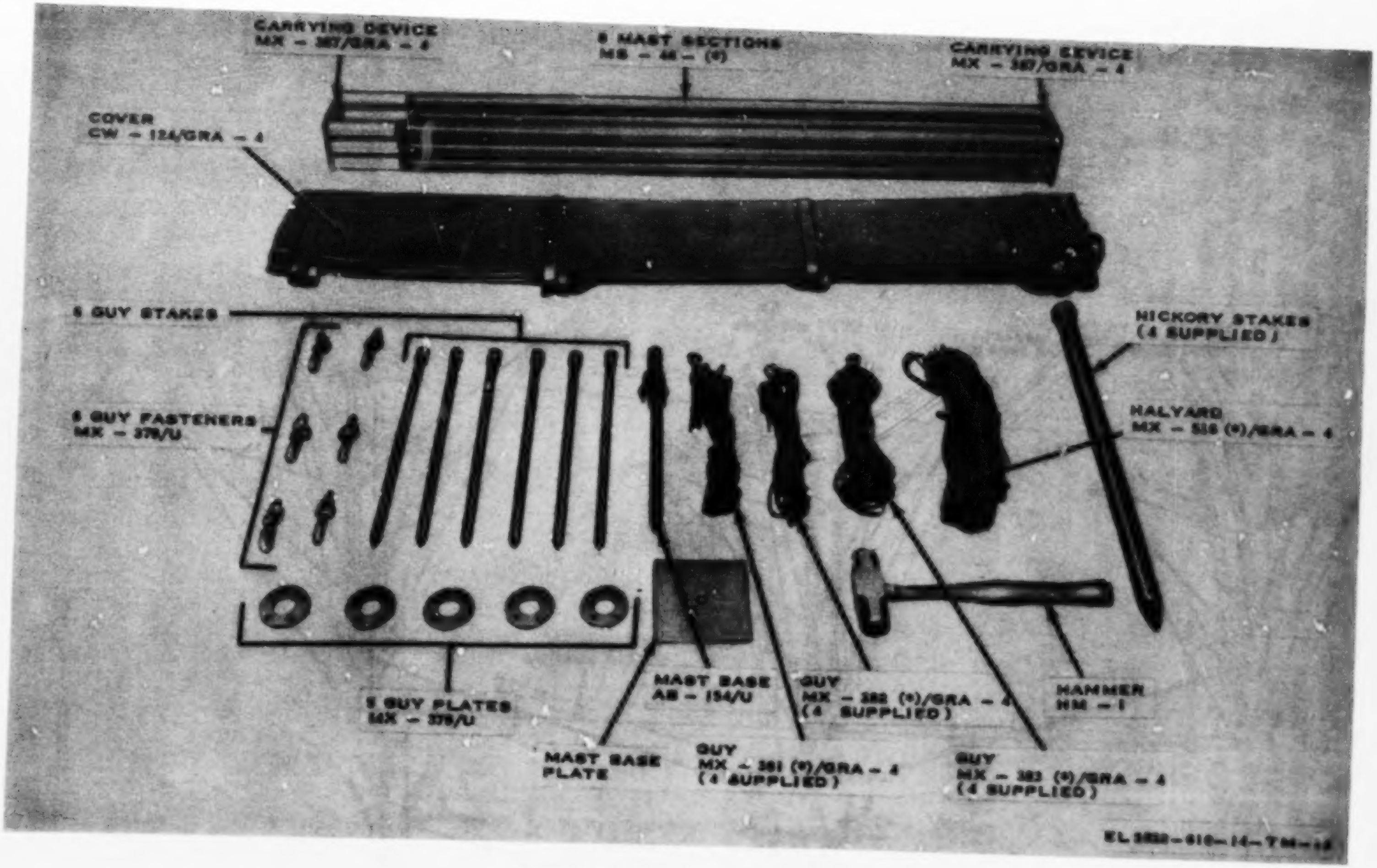

CARRYING DEVICE
MX – 387/GRA – 4
5 MAST SECTIONS
MS – 44 – (*)
CARRYING DEVICE
MX – 387/GRA – 4
COVER
CW – 124/GRA – 4
6 GUY STAKES
HICKORY STAKES
(4 SUPPLIED)
6 GUY FASTENERS
MX – 378/U
HALYARD
MX – 516 (*)/GRA – 4
5 GUY PLATES
MX – 379/U
MAST BASE
AB – 154/U
GUY
MX – 382 (*)/GRA – 4
(4 SUPPLIED)
HAMMER
HM – 1
MAST BASE
PLATE
GUY
MX – 381 (*)/GRA – 4
(4 SUPPLIED)
GUY
MX – 383 (*)/GRA – 4
(4 SUPPLIED)
EL 5820–410–14–TM–14

Figure 2-7. Mast AB-155A/U components.

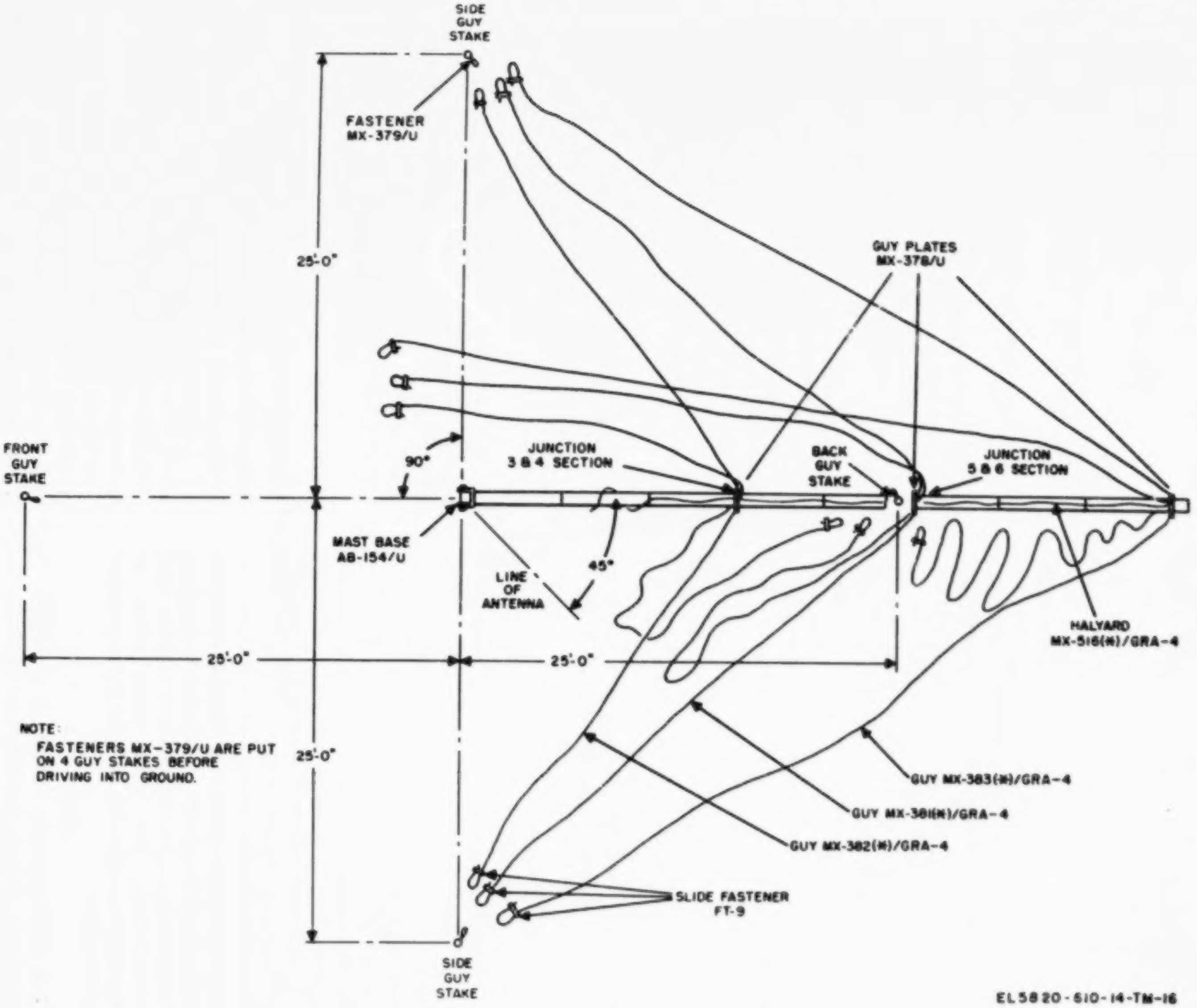

SIDE GUY STAKE
FASTENER MX-379/U
25'-0"
GUY PLATES MX-378/U
FRONT GUY STAKE
90°
JUNCTION 3 & 4 SECTION
BACK GUY STAKE
JUNCTION 5 & 6 SECTION
MAST BASE AB-154/U
LINE OF ANTENNA
45°
HALYARD MX-516(H)/GRA-4
25'-0"
25'-0"
NOTE:
FASTENERS MX-379/U ARE PUT ON 4 GUY STAKES BEFORE DRIVING INTO GROUND.
25'-0"
GUY MX-383(H)/GRA-4
GUY MX-381(H)/GRA-4
GUY MX-382(H)/GRA-4
SLIDE FASTENER FT-9
SIDE GUY STAKE
EL5820-510-14-TM-16

Figure 2-8. Preparing antenna mast for erection.

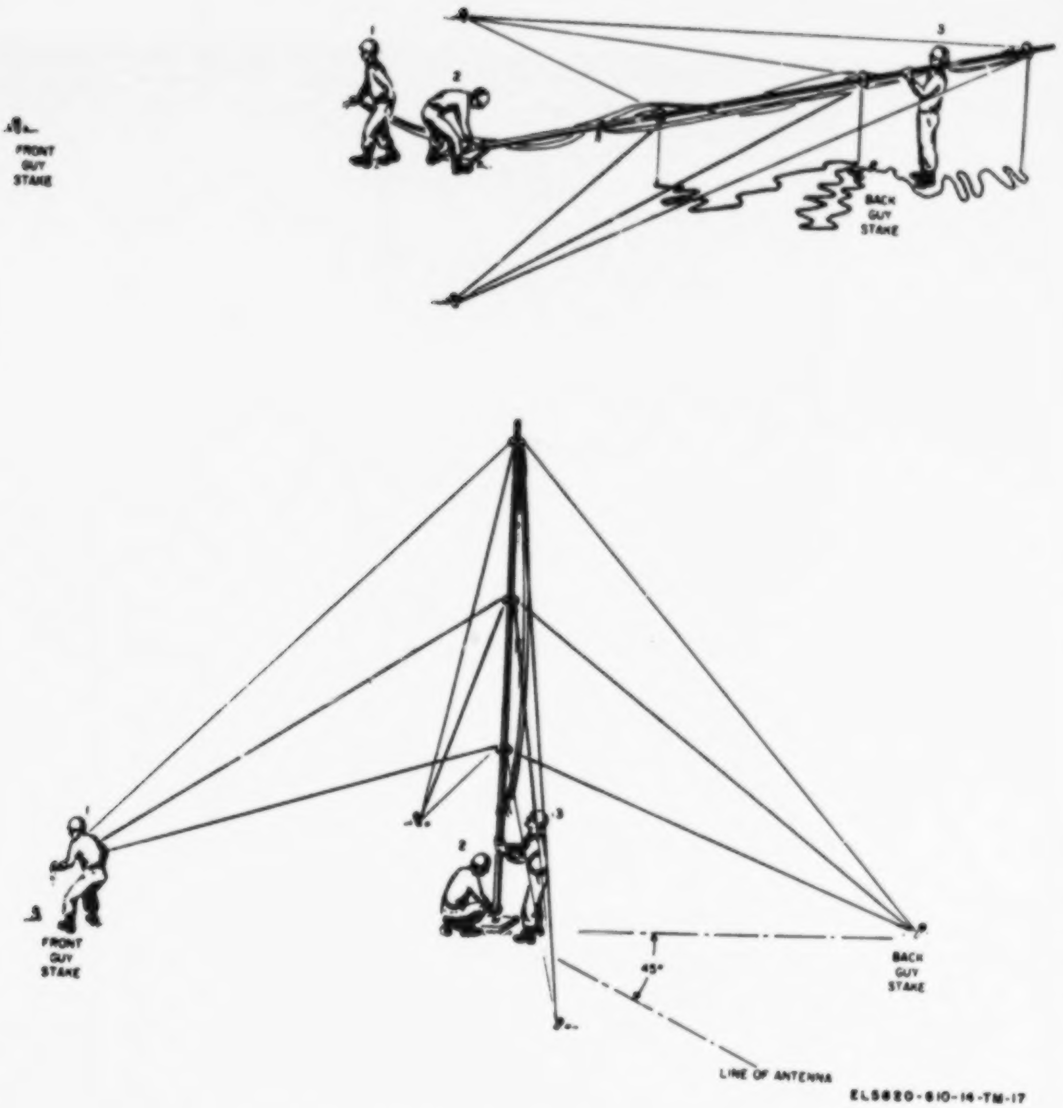


Figure 2-9. Raising assembled antenna mast.

2-8. Grounding Shelter

Before input power is connected, the shelter must be properly grounded when in a fixed or semifixed application. Select a site which will not interfere with the entrance door, field wires, power cables, or anticipated personnel traffic. Ground the terminal as instructed below:

NOTE

When the equipment is used in a mobile application, ground the shelter to the body of the carrying vehicle.

a. **Loosen the captive screws and lift the cover of the ac power and signal entrance panel (fig. 1-7). Straighten the stays to hold the cover up.**

b. **Remove the ground rod, ground strap, and** sledge hammer from their mounting (fig. 1-12) or storage drawer cabinet (fig. 1-14) in the shelter.

c. Select the lowest and dampest site within 10 feet of the ac power and signal entrance panel, preferably clay or loamy soil. Scoop out enough dirt to leave a 6-inch deep hole in the ground.

d. Place the shelter grounding system at earth potential by using the ground rod and the electrical lead. Drive the ground rod into the earth. Clamp one end of the electrical lead to the ground rod, attach the ground rod, and attach the free end of the lead to the shelter external GROUND TERMINAL (fig. 1-7).

e. When the shelter must be stationed over a soil having a very low conductivity, treat the soil to reduce its resistance. The soil can also be treated with substances that are highly conductive when in solution. Some of these substances, listed in order of preference, are: sodium chloride (common salt), calcium chloride, and magnesium sulphate (Epsom salt). The amount required depends on the type of soil and its moisture content.

2-9. Connections

a. Internal Connections. The AN/TRC-133A is shipped with all interunit cabling complete. Perform the procedures given below before making any external connections:

(1) Check to see that all equipment power switches are off.

(2) Check to see that all connectors and plugs of the exposed cables are securely connected.

(3) Check all power cords and connectors to see that they are secure and plugged into their respective receptacles.

b. External Power Connections (Fixed Station Operation). When the AN/TRC-133A is used under fixed or semifixed conditions, primary power is supplied by the PU-659 (PU-619M, modified) trailer mounted ac generators. A 100-foot ac power cable assembly CX-7453A/U and 15-foot stub CX-7705A/U are provided for connecting the shelter facility to the ac generator.

WARNING

Do not start the power unit until all power connections are made and appropriate safety precautions are taken. Installing personnel may be exposed to 115 volts ac at high current.

c. Remote Control Console Connections. Use the remote signal cables for connecting the remote control console to the shelter. Route the signal cable through the cable hooks provided on the ac power and signal entrance panel (fig. 1-7). This prevents undue strain on the cable connector.

(1) *Fixed operation.* Connect the remote control console to the shelter as follows:

(a) Remove the two RC-405/U reels containing the remote signal cables from the power unit trailer.

NOTE

One RC-405/U cable reel containing a single 500-foot signal cable assembly and one RC-405/U cable reel containing two 500-foot extending signal cable assemblies are supplied with each AN/TRC-133A.

(b) Remove the single 500-foot cable assembly labeled CONSOLE CABLE from its reel and connect it between J102 on the remote control console (fig. 1-9) and the REMOTE CONTROL connector on the ac power and signal entrance panel (fig. 1-7). This cable assembly must be used whenever the remote control console is used.

(c) If more than the above 500-foot signal cable is required to reach the remote location, insert one or both of the 500-foot extending cable assemblies labeled REMOTE CONSOLE between the shelter REMOTE CONTROL connector and the console cable assembly connector.

(2) *Mobile operation.* Connect the TA-312/PT telephone set located in the carrying vehicle cab to the ORDER WIRE binding posts on the dc entrance panel (A, fig. 1-8) to maintain communication between the shelter and the cab. Use a short piece of hookup wire (not provided) to make this connection.

d. Antenna cables. Secure the antenna cables so that they will not place undue strain on the antennas or on the connectors in the doublet antenna entrance panel located on the external right-hand wall of the shelter (B, fig. 1-8). Provide drip loops to prevent water from affecting the connections. When operating with doublet antennas, connect the antenna rf cable to the appropriate connector on the antenna entrance panel (fig. 1-8). Route the antenna rf cable assembly through the cable hooks to prevent undue strain on the panel connectors.

2-10. Installation of Operator's Rotary Chair
(fig. 1-6)

a. During fixed or semifixed operation, the rotary chair should be free for use at any of the operating positions. For mobile operation, the rotary chair should be securely anchored. Anchor the chair in place by screwing the threaded steel tiedown rod, mounted on the base of the chair, into the mounting plate located on the floor between positions 1 and 2. Handtighten until chair is firmly anchored.

b. If the chair is not to be used while in transit, secure the seat to the base with the web straps furnished, to keep the seat from swinging around.

CHAPTER 3

OPERATION

Section I. OPERATOR'S CONTROLS, INDICATORS, AND JACKS

NOTE

For information concerning the controls, indicators, and jacks of the equipment components comprising the AN/TRC-133A, refer to the applicable technical manual (appx A). For the controls, indicators, and jacks of the shelter power panels, 110VAC-28VDC switchbox, whip-ant switchbox, rf tuner TN-339/GR, amplifier input selector box, and the remote control console, refer to paragraphs 3-1 through 3-6 below.

3-1. Power Distribution Panels

a. AC POWER DISTRIBUTION PANEL (fig. 3-1).

Control or indicator	*Function*
MAIN (60A) circuit breaker (CB1)	Provides overload protection for the ac power generator and singular on-off control of all ac power in the shelter.
Distribution circuit breakers	Provides on-off control of power to and overload protection for the following equipments and circuitry.
POS 1 (15A) (CB2A)	Position 1.
POS 2 (15A) (CB2B)	Position 2.
POS 3 (15A) CB3A)	Position 3.
POS 4 (15A) (CB3B)	Position 4.
POS 5 (15A) (CB4A)	Position 5.
AMPL (15A) (CB4B)	RF Amplifier AM-3979/FRC-93 and amplifier input selector box.
BLO (15A) (CB5A)	Exhaust blower.
DUCT (15A) (CB5B)	Duct blower.
CONV (20A) (CB7A)	Convenience receptacles.
LIGHTS (20A) (CB7B)	Fluorescent and incandescent lights.
HTR 1 (20A) (CB6A)	Heater #1.
HTR 2 (20A) (CB6B)	Heater #2.
DC SUP (15A) (CB8A)	Dc power supply (ac to dc converter for remote control console.
SPARE (15) (CB8B)	To be used as required.
MAIN power indicator light (NE-48 neon)	Indicates application of ac power to the shelter.
POWER ON indicator lights (NE-51 neon)	Will light when its associated circuit breaker is switched on, indicating application of power to the designated equipment.
Voltmeter (0 to 150 volts).	Indicates level of applied ac voltage.
Ammeter (0 to 100 amp).	Indicates level of current drain on the ac generator.

b. Dc Power Distribution Panel (fig. 3-1).

Control or indicator	*Function*
MAIN (50A) circuit breaker (CB9).	Provides overload protection for carrying vehicle battery and singular on-off control of all dc power in the shelter.
Distribution circuit breakers.	Provide on-off (push-pull) control of dc power to and overload protection for the following equipments and circuitry.
POS-1 (15A) (CB10).	516E-2 dc power supply.
POS-2 (15A) (CB11).	516E-2 dc power supply.
LIGHT (10A) (CB12).	Dc light.
FAN (10A) (CB13).	Dc fan.
REMOTE (5A) (CB14).	Remote console.
Indicator lamps (NE-51 neon).	Will light when its associated circuit breaker is switched on, indicating application of power to the designated equipment.
Voltmeter (0 to 50 volts).	Indicates level of applied dc voltage.

3-2. 110VAC-28VDC Switchbox (Pos 1 and 2).
(A, fig. 3-3)

Control	Function
110VAC-28VDC	Two-position switch to select type of voltage required to operate equipment at positions 1 and 2 as follows:

SW pos	Function
110VAC	Connects equipment to ac power during fixed mode of operation.
28VDC	Connects equipment to dc power during mobile mode of operation.

3-3. WHIP-ANT Switchbox (Pos 1 and 2)
(B, fig. 3-3)

Control	Function
WHIP-ANT	Two-position switch to select type of antenna required for use of equipment at positions 1 and 2 as follows:

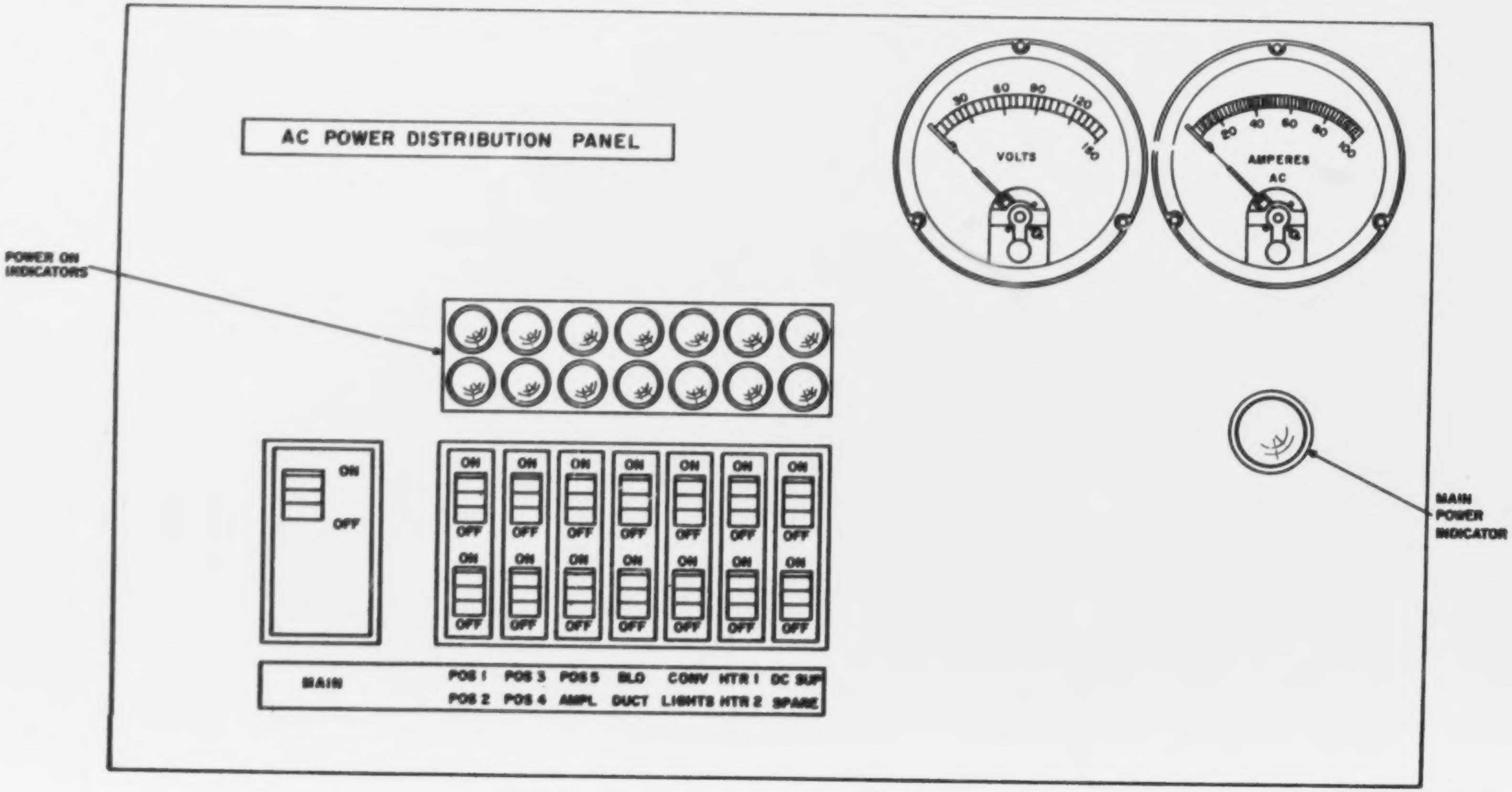
SW pos	Function
WHIP	Connects position equipment to a whip antenna during mobile mode of operation.
ANT	Connects position equipment to a doublet antenna during fixed mode of operation.

3-4. Tuner, Radio Frequency TN-339/ GR
(fig. 3-4)

Control or indicator	Function
COUPLING	Varies the amount of current in the whip antenna.
FREQUENCY 2MC INCREASE 10MC	Adjusts the antenna loading to the transceiver in the low-frequency range.
FREQUENCY 10 MC INCREASE 18MC	Adjusts the antenna loading to the transceiver in the high-frequency range.
Range switch	Three-position switch for use as follows:

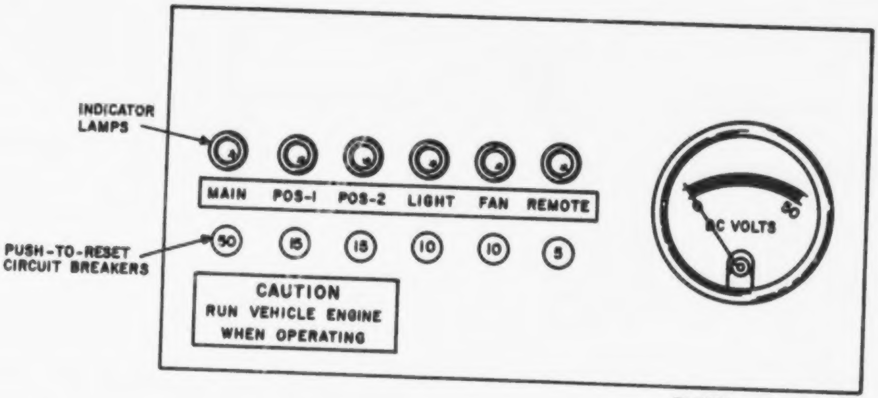
SW pos	Function
2-10MC	Matches the whip antenna to the transceiver when operating in low-frequency range.
10-20MC	Matches the whip antenna to the transceiver when operating in the high-frequency range.
LONG WIRE	Matches a long wire antenna to a transceiver when operating over the entire frequency range (2-20MC).

Control or indicator	Function
ANTENNA CURRENT meter	Measures the rf current in the whip antenna.


AC POWER DISTRIBUTION PANEL
POWER ON INDICATORS
MAIN POWER INDICATOR
VOLTS
30 60 90 120 150
AMPERES AC
20 40 60 80 100
ON
OFF
MAIN
POS 1 POS 2
POS 3 POS 4
POS 5 AMPL
BLO DUCT
CONV LIGHTS
HTR 1 HTR 2
DC SUP SPARE

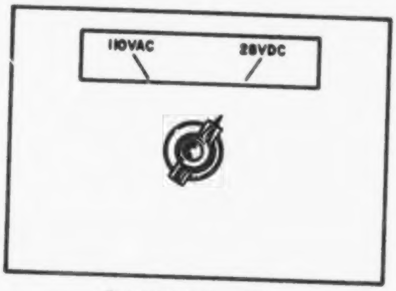
EL3820-610-14-TM-21

Figure 3-1. AC POWER DISTRIBUTION PANEL controls and indicators.

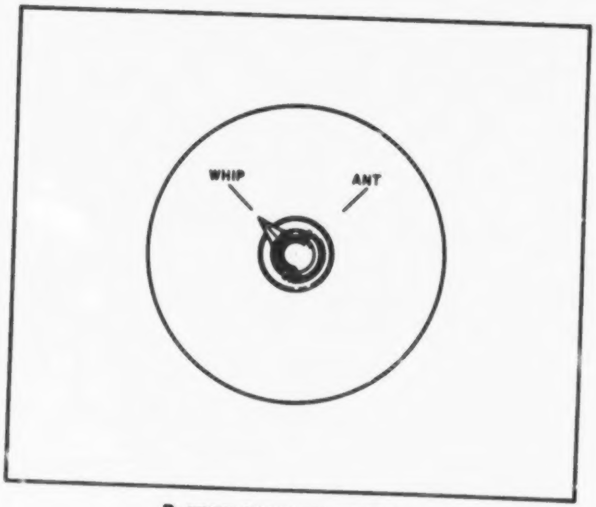

INDICATOR LAMPS
MAIN
POS-1
POS-2
LIGHT
FAN
REMOTE
PUSH-TO-RESET CIRCUIT BREAKERS
50
15
15
10
10
5
CAUTION
RUN VEHICLE ENGINE
WHEN OPERATING
DC VOLTS
30

EL5820-610-14-TM-22

Figure 3-2. Dc power distribution panel controls and indicators.


110VAC
28VDC

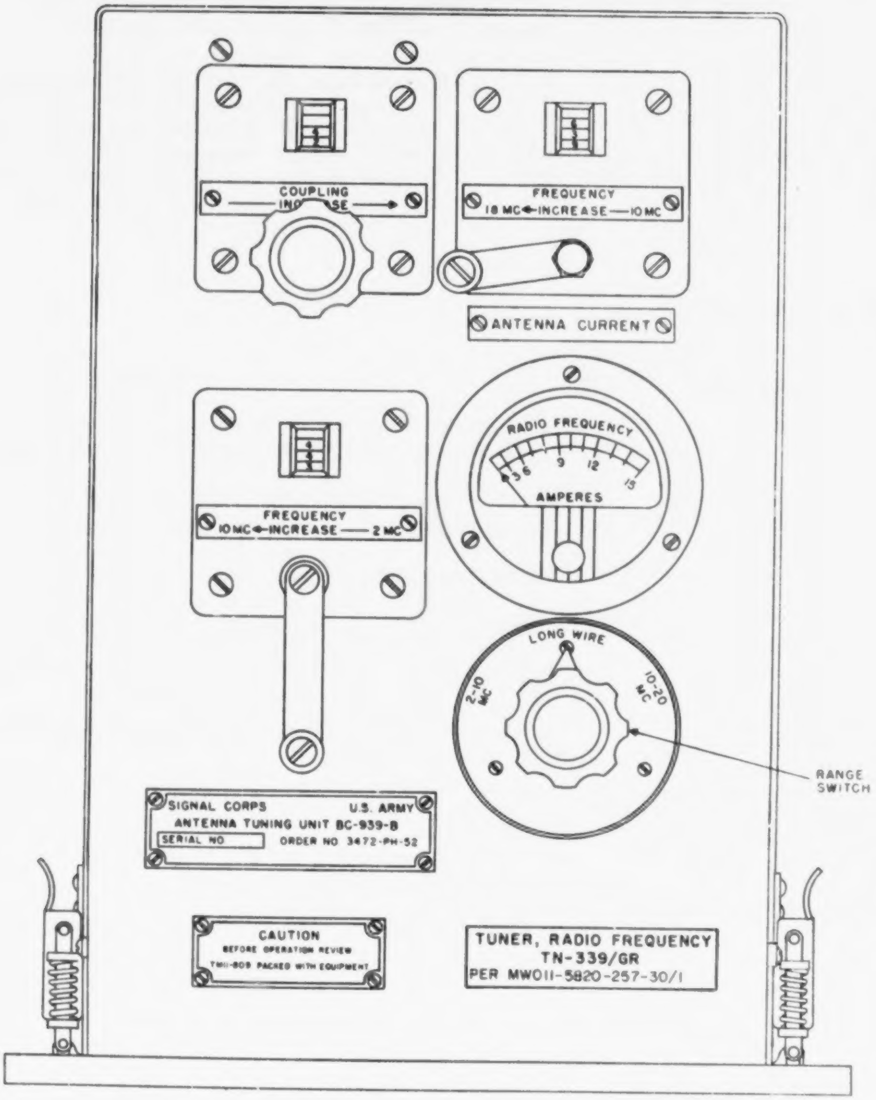
A. 110 VAC-28VDC SELECTOR SWITCH.



B. WHIP-ANTENNA SWITCH.

EL5820-610-14-TM-23

Figure 3-3. Power and whip antenna switching controls.


COUPLING
INCREASE
FREQUENCY
18 MC ← INCREASE — 10 MC
ANTENNA CURRENT
FREQUENCY
10 MC ← INCREASE — 2 MC
RADIO FREQUENCY
3 6 9 12 15
AMPERES
LONG WIRE
2-10 MC
10-20 MC
RANGE SWITCH
SIGNAL CORPS U.S. ARMY
ANTENNA TUNING UNIT BC-939-B
SERIAL NO
ORDER NO 3472-PH-52
CAUTION
BEFORE OPERATION REVIEW
TM11-809 PACKED WITH EQUIPMENT
TUNER, RADIO FREQUENCY
TN-339/GR
PER MWO11-5820-257-30/1

EL5820-610-14-TM-43

Figure 3-4. Tuner, Radio Frequency TN-339/GR.

3-5. Amplifier Input Selector Box
(fig. 3-5)

Control or indicator	*Function*
AMPLIFIER INPUT SELECTOR switch.	Six-position switch which controls the input to RF Amplifier AM-3979/FRC-93 as follows:

Sw pos	*Function*
1	Output rf signal from transceiver at position 1 is fed through linear amplifier. Indicator lamp will illuminate showing position 1 radio equipment is connected to the amplifier. Used only in fixed operation.
2	Same as above except position 2 radio equipment is connected to the amplifier. Indicator lamp 2 will light.
3	Same as above except position 3 radio equipment is connected to the amplifier. Indicator lamp 3 will light.

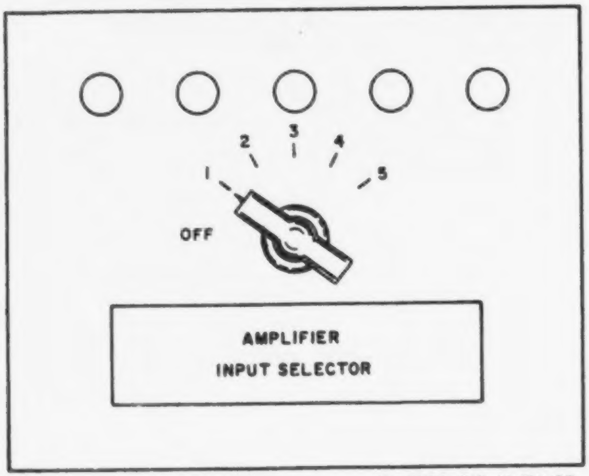
Sw pos	*Function*
4	Same as above except position 4 radio equipment is connected the amplifier. Indicator lamp 4 will light.
5	Same as above except position 5 radio equipment is connected the amplifier. Indicator lamp 5 will light.
OFF	Rf amplifier not being used. Transceiver rf output from position fed directly to a doublet antenna.

3-6. Directional Wattmeter 302C-3 (fig. 3-6)

Control or indicator	*Function*
WATTS (power) selector switch	Four-position switch for selecting proper meter circuitry for determinin standing wave ratio (swr) on the transmission line, as follows:

Sw pos	*Function*
REFLECTED 200	Selects proper meter circuitry to measure reflecte power up to 200 watts.
REFLECTED 2000	Selects proper meter circuitry to measure reflecte power up to 2000 watts.
FORWARD 2000	Selects proper meter circuitry to measure forwar power up to 2000 watts.
FORWARD 200	Selects proper meter circuitry to measure forwar power up to 200 watts.

Wattmeter	Indicates the amount of forward and reflected power for determining the swr of the transmission line.



EL5820-610-14-TM-25

Figure 3-5. Rf amplifier input selector.

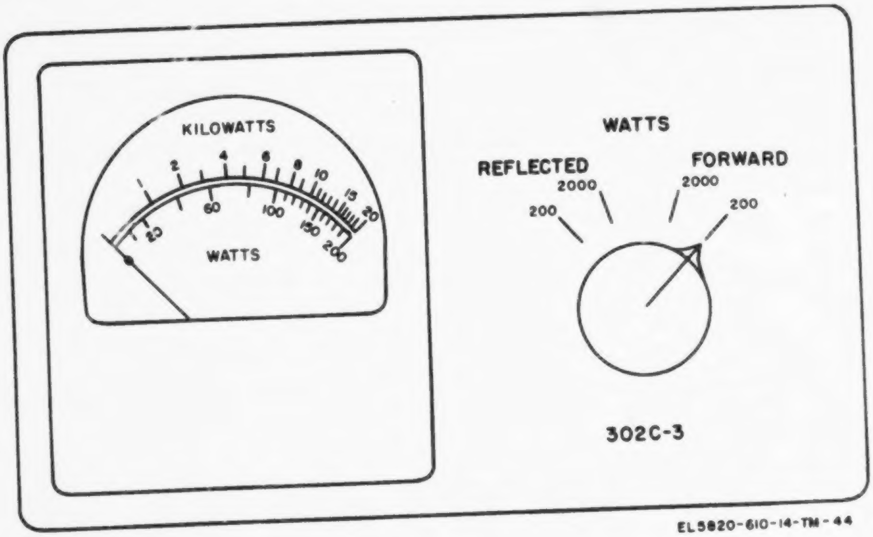


Figure 3-6. Directional wattmeter.

3-7. Remote Control Console and Light Amplifier

a. Remote Control Console (fig. 3-7).

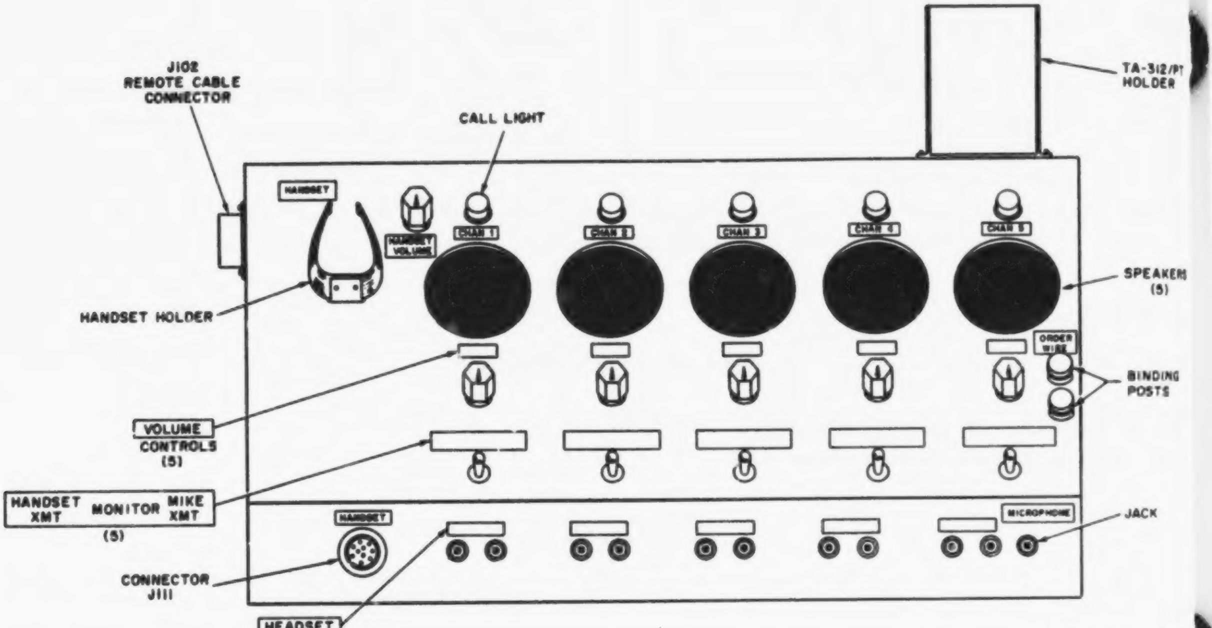
Control, indicator, or jack	*Function*
Phone jack	Two jacks per position for plugging in headsets. (Speaker and headset are both in use when headset plug is inserted in left-hand jack and selector switch is at MONITOR or MIKE XMT. Headset operates and speaker is muted when headset plug is inserted in right-hand jack and selector switch is at MONITOR or MIKE XMT.)
MICROPHONE jack	Permits use of the dynamic microphone from the remote console.
HANDSET XMT-MONITOR-MIKE XMT lever switch.	Three-position switch for use as follows:

Sw pos	*Function*
HANDSET XMT	Position speaker muted. Position transceiver controlled by handset. Handset volume control operates.
MONITOR	Position speaker operates (headset plug in left-hand position jack). Unable to key position transmitters. Speaker volume control operates.
MIKE XMT	Position speaker operates (headset plug in left-hand position jack). Microphone is connected to MICROPHONE jack. Position transceivers controlled by microphone. Speaker volume control operates.

HANDSET VOLUME	Adjusts the volume level in the handset.
VOLUME (5 ea)	Adjusts the volume level of the speakers.
HANDSET connector (J111)	Connects the handset for use at the remote console.
ORDER WIRE binding posts	Connect TA-312/PT on remote control console to phone in shelter.
Call lights	Provide a visual indication (light on) to the console operator upon the reception of a signal at that position.
HANDSET (on rear panel) (fig. 3-8)	Adjusts level of audio input to HANDSET microphone amplifier.
MICROPHONE (on rear panel)	Adjusts level of audio input to MICROPHONE amplifier.
SIDETONE (on rear panel)	Adjusts volume of sidetone of signal being transmitted.

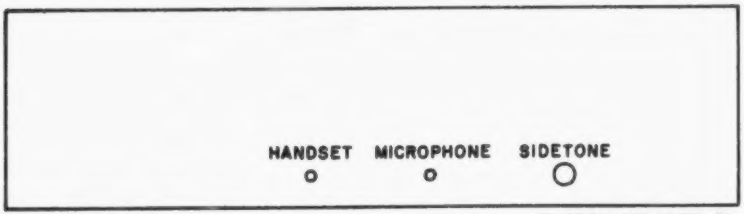
b. Light Amplifiers (fig. 3-9).

Control, indicator, or jack	*Function*
ADJ CH-1—CH-5	Determines the signal levels from the transceivers that will light the channel call lights on the remote control unit


J102
REMOTE CABLE
CONNECTOR
CALL LIGHT
TA-312/PT
HOLDER
HANDSET
HANDSET
VOLUME
CHAN 1
CHAN 2
CHAN 3
CHAN 4
CHAN 5
SPEAKER
(5)
HANDSET HOLDER
ORDER
WIRE
BINDING
POSTS
VOLUME
CONTROLS
(5)
HANDSET
XMT
MONITOR
MIKE
XMT
(5)
HANDSET
MICROPHONE
JACK
CONNECTOR
J111
HEADSET
PHONE JACKS (5)

EL5820-610-14-TM-24

Figure 3-7. Remote control console controls and indicators.


HANDSET
MICROPHONE
SIDETONE

EL5820-610-14-TM-51

Figure 3-8. Remote control console, rear panel controls.

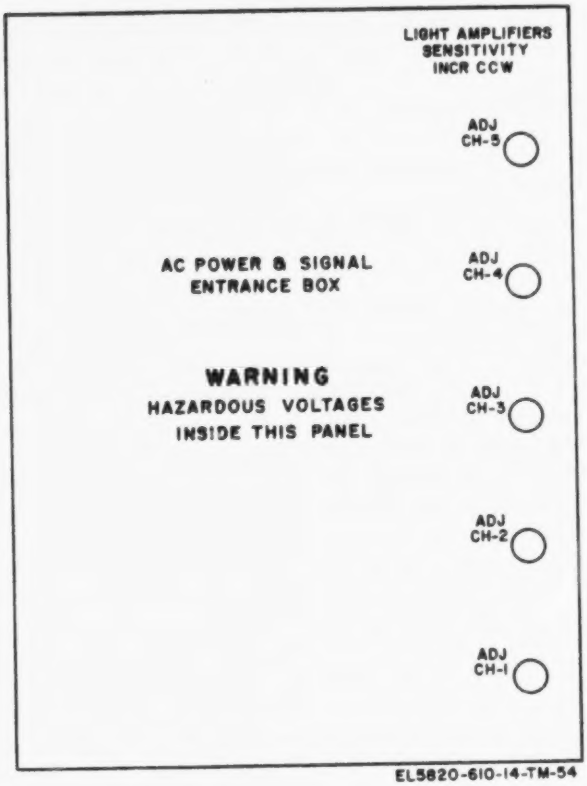

LIGHT AMPLIFIERS
SENSITIVITY
INCR CCW
ADJ
CH-5
AC POWER & SIGNAL
ENTRANCE BOX
ADJ
CH-4
WARNING
HAZARDOUS VOLTAGES
INSIDE THIS PANEL
ADJ
CH-3
ADJ
CH-2
ADJ
CH-1
EL5820-610-14-TM-54

Figure 3-9. Ac power and signal entrance box controls.

Section II. PRELIMINARY OPERATING PROCEDURES

WARNING

Before operating the equipment, make certain all requirements of TB SIG 291 are met. Injury or DEATH could result from improper or careless operation.

3-8. Starting Procedures

a. Fixed Station Operation.

CAUTION

When operating from a fixed or semifixed location, be sure that the power source, shelter, and trailer are grounded before starting the power source (para 2-8). Failure to do so may result in severe electrical shock.

(1) Check to see that the power cable, antennas, and remote cabling (if used) are properly connected.

(2) Lock the air intake and exhaust ports on the front wall and door of the shelter in the open position.

(3) Set all circuit breakers on the AC POWER DISTRIBUTION PANEL to OFF (fig. 1-13). On the ac generator, see that the appropriate switches or circuit breakers are in the off position. (Refer to appendix A for the applicable manual.)

(4) Start the power generator. Flip all appropriate switches or circuit breakers on the generator to ON. The large red neon indicator on the AC POWER DISTRIBUTION PANEL in the shelter will light to indicate the application of ac power to the shelter.

(5) Operate the AC POWER DISTRIBUTION PANEL circuit breakers as follows (fig. 3-1):

NOTE

As each circuit breaker (excepting the MAIN) on the AC POWER DISTRIBUTION PANEL is set to ON, a neon lamp above the circuit breaker will light, indicating application of power to that particular circuit.

(a) MAIN to ON.
(b) LIGHTS to ON.
(c) BLO to ON.
(d) DUCT to ON.

(e) POS 1 through 5 to ON (depending upon equipment positions to be used).

(f) AMPL to ON.

(g) HTR 1 and 2 to ON, as required.

(h) CONV to ON.

(i) DC SUP to ON (if remote console is to be used.)

(6) Set the FLUORESCENT LIGHT switch to ON (fig. 1-13).

(7) Set the INCANDESCENT LIGHT DIMMER/CONTROL switch to ON (push in); adjust for desired brightness.

(8) Set the BLACKOUT-BYPASS toggle switch to the position required. (In BLACKOUT position, a microswitch located near the door above the AC POWER DISTRIBUTION PANEL will turn off all shelter ac lights when the door is opened. To disable the microswitch, set the BLACKOUT-BYPASS toggle switch to BYPASS.)

(9) Be sure all equipment power switches are at OFF.

(10) Set the WHIP-ANT selector switches to ANT (fig. 3-3).

(11) Set the AMPLIFIER INPUT SELECTOR switch to OFF (fig. 3-5).

(12) Set the 110VAC-28VDC selector switch to 110VAC (fig. 3-3).

b. Mobile Operation.

(2) Check to see that the following connections have been made to the dc power and signal entrance box on the outside front wall of the shelter (A, fig. 1-8).

(a) Dc power cable is connected between the carrying vehicle battery and the 28VDC connector.

(b) Ground braid is connected between the vehicle body and ground terminal.

(c) Field wires have been connected between the telephone (TA-312/PT) in the vehicle cab and the ORDER WIRE binding posts, if required.

(2) Check to see that the whip antenna is installed (para 2-5) and properly connected.

(3) Check to see that the WHIP-ANT selector switch is set to WHIP at positions 1 and 2.

(4) Lock the air intake and exhaust ports on the front wall and rear door of the shelter in their open positions.

(5) Set all circuit breakers on the dc power distribution panel to off (fig. 3-2).

(6) Set the 110VAC-28VDC selector switch to 28VDC.

(7) Set positions No. 1 and 2 equipment power switches to off.

(8) Throw the dc power distribution panel MAIN circuit breaker to on. The MAIN indicator lamp will light and the 0-50 VOLT DC meter will indicate the voltage level of the battery source (28 volts nominal). It may be necessary for the vehicle operator to adjust the vehicle throttle to obtain a meter indication of 28VDC.)

WARNING

Be sure that the vehicle engine is running before throwing any of the equipment circuit breakers to ON, to prevent the application of a heavy load to the battery.

(9) On the dc power distribution panel, throw the FAN, LIGHT, and POS 1 and POS 2 circuit breakers to ON. The associated indicator lamps on the panel will light to indicate application of dc power to the circuit.

(10) The DC light can be turned on and off, as required, by use of the on-off switch mounted on the light fixture.

(11) Direct the airflow from the dc fan toward positions No. 1 and 2 equipment.

3-9. Transceiver Preoperational Procedures

a. Crystal Installation.

(1) The transceiver has provisions for the installation of 28 crystals. Two crystal boards, each containing 14 crystal sockets, are mounted in the transceiver. One, located on the main frame, is accessible from the top of the transceiver. The other, located below the main frame, is accessible through a square hole in the bottom of the transceiver case.

(2) Install the crystals as follows:

(a) Set the transceiver crystal board selector switch to the right-hand position (TM 11-5820-529-15).

(b) Remove the crystal packets from the shelter crystal storage drawer.

(c) Select the required crystals from the crystal packet for the operating frequencies to be used (Table 3-1).

(d) Install the crystals in the top (main frame) crystal board, using the crystal socket for each frequency as indicated in Table 3-1.

(e) As each crystal is inserted into the crystal board, record in pencil on the frequency band indicator chart, the frequency for that position of the transceiver BAND switch.

(f) After all crystals have been installed in the top (main frame) crystal board, set the transceiver crystal board selector switch to the left-hand position.

(g) Insert the required crystals in the bottom (below main frame) crystal board, following the procedures given in (c) through (e) above.

Table 3-1. Transceiver Crystal Frequency Band, Crystal, and Socket

Operating frequency band (MHz)	*Crystal frequency (kHz)*	*Crystal socket*
3.4- 3.6	6555.000	1A, 2A or 3A
3.6- 3.8	6755.000	1A, 2A or 3A
3.8- 4.0	6955.000	1A, 2A or 3A
4.0- 4.2	7155.000	1A, 2A or 3A
4.2-4.4	7355.000	1A, 2A or 3A
4.4- 4.6	7555.000	1A, 2A or 3A
4.6- 4.8	7755.000	1A. 2A or 3A
4.8- 5.0	7955.000	1A, 2A or 3A
6.6- 6.8	9755.000	1B or 2B
6.8- 7.0	9955.000	1B or 2B
7.0- 7.2	10155.000	1B or 2B
7.2- 7.4	10355.000	1B or 2B
7.4- 7.6	10555.000	1B or 2B
7.6- 7.8	10755.000	1B or 2B
7.8- 8.0	10955.000	1B or 2B
8.0- 8.2	11155.000	1B or 2B
8.2- 8.4	11355.000	1B or 2B
8.4- 8.6	11555.000	1B or 2B
8.6- 8.8	11755.000	1B or 2B
8.8- 9.0	11955.000	1B or 2B
9.0- 9.2	12155.000	1B or 2B
9.2-9.4	12355.000	1B or 2B
9.4- 9.6	12555.000	1B or 2B
9.6- 9.8	12755.000	1C, 2C or 3C
9.8-10.0	12955.000	1C, 2C or 3C
10.0-10.2	13155.000	1C, 2C or 3C
10.2-10.4	13355.000	1C, 2C or 3C
10.4-10.6	13555.000	1C, 2C or 3C
10.6-10.8	13755.000	1C, 2C or 3C
10.8-11.0	13955.000	1C, 2C or 3C
11.0-11.2	14155.000	1C, 2C or 3C
11.2-11.4	14355.000	1C, 2C or 3C
11.4-11.6	14555.000	1C, 2C or 3C
11.6-11.8	14755.000	1C, 2C or 3C
11.8-12.0	14955.000	1C, 2C or 3C
12.0-12.2	7577.500	1C, 2C or 3C
12.2-12.4	7677.500	1C, 2C or 3C
12.4-12.6	7777.500	1C, 2C or 3C
12.6-12.8	7877.500	1C, 2C or 3C
12.8-13.0	7977.500	1C, 2C or 3C
13.0-13.2	8077.500	1C, 2C or 3C
13.2-13.4	8177.500	1C, 2C or 3C
13.4-13.6	8277.500	1C, 2C or 3C
13.6-13.8	8377.500	1C, 2C or 3C
13.8-14.0	8477.500	1C, 2C or 3C
14.0-14.2	8577.500	1C, 2C or 3C
14.2-14.4	8677.500	1C, 2C or 3C
14.4-14.6	8777.500	1C, 2C or 3C
14.6-14.8	8877.500	1C, 2C or 3C
14.8-15.0	8977.500	1C, 2C or 3C
15.0-15.2	9077.500	1D, 2D or 3D
15.2-15.4	9177.500	1D, 2D or 3D
15.4-15.6	9277.500	1D, 2D or 3D
15.6-15.8	9377.500	1D, 2D or 3D
15.8-16.0	9477.500	1D, 2D or 3D
16.0-16.2	9577.500	1D, 2D or 3D
16.2-16.4	9677.500	1D, 2D or 3D
16.4-16.6	9777.500	1D, 2D or 3D
16.6-16.8	9877.500	1D, 2D or 3D
16.8-17.0	9977.500	1D, 2D or 3D
17.0-17.2	10077.500	1D, 2D or 3D
17.2-17.4	10177.500	1D, 2D or 3D

Table 3-1. Transceiver Crystal Frequency Band, Crystall, and Socket—Continued

Operating frequency band (MHz)	*Crystal frequency (kHz)*	*Crystal socket*
17.4-17.6	10277.500	1D, 2D or 3D
17.6-17.8	10377.500	1D, 2D or 3D
17.8-18.0	10477.500	1D, 2D or 3D
18.0-18.2	10577.500	1D, 2D or 3D
18.2-18.4	10677.500	1D, 2D or 3D
18.4-18.6	10777.500	1D, 2D or 3D
18.6-18.8	10877.500	1D, 2D or 3D
18.8-19.0	10977.500	1D, 2D or 3D
19.0-19.2	11077.500	1D, 2D or 3D
19.2-19.4	11177.500	1D, 2D or 3D
19.4-19.6	11277.500	1D, 2D or 3D
19.6-19.8	11377.500	1D, 2D or 3D
19.8-20.0	11477.500	1D, 2D or 3D
20.0-20.2	11577.500	1D, 2D or 3D
20.2-20.4	11677.500	1D, 2D or 3D
20.4-20.6	11777.500	1D, 2D or 3D
20.6-20.8	11877.500	1D, 2D or 3D
20.8-21.0	11977.500	1D, 2D or 3D
21.0-21.2	12077.500	1D, 2D or 3D
21.2-21.4	12177.500	1D, 2D or 3D
21.4-21.6	12277.500	1D, 2D or 3D
21.6-21.8	12377.500	1D, 2D or 3D
21.8-22.0	12477.500	1D, 2D or 3D
22.0-22.2	12577.500	1E, 2E or 3E
22.2-22.4	12677.500	1E, 2E or 3E
22.4-22.6	12777.500	1E, 2E or 3E
22.6-22.8	12877.500	1E, 2E or 3E
22.8-23.0	12977.500	1E, 2E or 3E
23.0-23.2	13077.500	1E, 2E or 3E
23.2-23.4	13177.500	1E, 2E or 3E
23.4-23.6	13277.500	1E, 2E or 3E
23.6-23.8	13377.500	1E, 2E or 3E
23.8-24.0	13477.500	1E, 2E or 3E
24.0-24.2	13577.500	1E, 2E or 3E
24.2-24.4	13677.500	1E, 2E or 3E
24.4-24.6	13777.500	1E, 2E or 3E
24.6-24.8	13877.500	1E, 2E or 3E
24.8-25.0	13977.500	1E, 2E or 3E
25.0-25.2	14077.500	1E, 2E or 3E
25.2-25.4	14177.500	1E, 2E or 3E
25.4-25.6	14277.500	1E, 2E or 3E
25.6-25.8	14377.500	1E, 2E or 3E
25.8-26.0	14477.500	1E, 2E or 3E
26.0-26.2	14577.500	1E, 2E or 3E
26.2-26.4	14677.500	1E, 2E or 3E
26.4-26.6	14777.500	1E, 2E or 3E
26.6-26.8	14877.500	1E, 2E or 3E
26.8-27.0	14977.500	1E, 2E or 3E
27.0-27.2	15077.500	1E, 2E or 3E
27.2-27.4	15177.500	1E, 2E or 3E
27.4-27.6	15277.500	1E, 2E or 3E
27.6-27.8	15377.500	1E, 2E or 3E
27.8-28.0	15477.500	1E, 2E or 3E
28.0-28.2	15577.500	1E, 2E or 3E
28.2-28.4	15677.500	1E, 2E or 3E
28.4-28.6	15777.500	1E, 2E or 3E
28.5-28.7	15827.500	1E, 2E or 3E
28.6-28.8	15877.500	1E, 2E or 3E
28.8-29.0	15977.500	1E, 2E or 3E
29.0-29.2	16077.500	1E, 2E or 3E
29.2-29.4	16177.500	1E, 2E or 3E
29.4-29.6	16277.500	1E, 2E or 3E
29.6-29.8	16377.500	1E, 2E or 3E
29.8-30.0	16477.500	1E, 2E or 3E

b. Transceiver Bias Adjustment.

(1) *Fixed station operation.*

(*a*) Perform the fixed station starting procedure (para 3–8*a*).

(*b*) Check to see that the proper crystals are installed in the transceiver (para 3–9*a*).

(*c*) Set the transceiver controls as follows:

1. OFF-ON-NB-CAL switch to OFF.

2. MIC GAIN control to OFF.

3. EMISSION switch to LSB or USB as required.

4. METER switch to PLATE.

NOTE

All other transceiver controls require no specific settings.

(*d*) Set the OFF-ON-NB-CAL switch to ON and allow the transceiver to warm up for 10 minutes.

(*e*) Set the EMISSION switch to LOCK and observe the plate current meter. A plate current indication of 38 to 42 milliamperes (ma) should be observed. If not, adjust the ac power supply (PP–4151/FRC–93 (516F–2)) BIAS control for a plate current indication of 40 ma. If the transceiver is to be used with linear RF Amplifier AM–3979/FRC–93 (30L–1), set the BIAS control to produce 50-ma idling plate current.

(*f*) Set the transceiver EMISSION switch to LSB or USB as required.

(*g*) Repeat the procedure ((*b*) through (*f*) above) for the transceiver at each of the five equipment positions.

(2) *Mobile operation.*

(*a*) Perform the mobile shelter starting procedure (para 3–8*b*).

(*b*) Perform (1) (*b*) through (*f*) above on equipment at positions 1 and/or 2; however, adjust the dc Power Supply PP–4765/GRC–159(V) BIAS control for a plate current indication of 40 ma.

c. Transceiver Calibration

(1) After all transceiver crystals have been installed (*a* above) and bias properly adjusted (*b* above), the transceiver must be calibrated to assure operation on the designated frequency. Calibrate the transceiver as follows:

(*a*) Set the transceiver controls as follows:

1. OFF-ON-NB-CAL switch to ON.

2. EMISSION switch to USB or LSB as required.

3. Crystal board selector switch to left or right, as required, to display the desired operating band.

4. BAND switch to desired operating frequency band.

5. MIC GAIN control to OFF.

6. RF GAIN control fully clockwise.

7. VOX GAIN (under top cover) fully counterclockwise.

8. ANTI=VOX GAIN (under top cover) fully counterclockwise.

(*b*) Set the C–6118/FRC–93 (312B–4) (fig. 1–10) controls as follows:

1. FUNCTION switch to NORMAL.

2. PHONE PATCH swtich to OFF.

(*c*) Adjust the A.F. GAIN control until some receiver noise is heard in the C–6118/FRC–93 loudspeaker.

(*d*) Set the EXCITER TUNING control to the desired operating frequency band, then fine-tune until maximum receiver noise is heard in the C–6118/FRC–93 loudspeaker.

(*e*) Set the OFF-ON-NB-CAL switch to CAL.

(*f*) Adjust the MAIN TUNING control to the nearest 100-kHz point (0, 100, or 200) and then fine-tune until an audible beat note is heard.

(*g*) Decrease the RF GAIN control to provide a comfortable signal volume level.

(*h*) Adjust the MAIN TUNING control until a zero beat condition is obtained, as heard on the speaker.

(*i*) Adjust the ZERO SET control until the index mark (hairline) is in line with the 0, 100, or 200 mark on the main tuning dial.

(*j*) Set the OFF-ON-NB-CAL switch to ON and set the dial to the desired portion of the 200-kHz band selected.

(2) Repeat the procedure ((*a*) through (*j*) above) for the transceivers at the remaining equipment positions.

d. Transmitter Tuning. Several methods of connecting a dummy load to the transmitter for tuning purposes may be employed by the operator. However, the following procedures are recommended, using the dummy loads provided:

(1) *Using Dummy Load DA–412A/U* (Bird Model 8401). Connect the DA–412A/U as follows:

(*a*) At the doublet antenna panel, remove the rf cable for the equipment position transceiver being tuned or checked.

(*b*) Using the N-type connector adapter (UG–30D/U) provided, connect the rf cable, which was removed above, to the 3-foot dummy load cable which is provided for this purpose.

(*c*) Connect the extended rf cable to the female N-type connector on the DA–412A/U. Perform procedures outlined in (2) (d) through (p) below.

NOTE

1. Use the chart below to identify rf cabling from each position to the antenna panel.

Equip pos	*Rf cable designation*
1	RF3-11
2	RF3-12
3	RF3-13
4	RF3-14
5	RF3-15

2. An alternate method of coupling the DA-412A/U to the transceiver output is to select the position to be tuned on the amplifier input selector switch and connect the rf cable (RF2-2) between the directional coupler (located behind the amplifier) and the DA-412A/U. (The rf amplifier need not be at ON for this purpose.)

(2) *Using Dummy Load DL-1.* During normal operation (RF Amplifier AM-3979/FRC-93 *not* in use), the DL-1 can be used to tune the transmitter. Using the cables provided, proceed as follows:

(*a*) Connect a cable from the RF OUT jack on the transceiver to the TRANSMITTER JACK (J2) on the DL-1.

(*b*) Connect a cable from the 6.3 VAC jack (J19) on the transceiver to the 6.3 VAC jack (J4) on the DL-1.

(*c*) Set the REMOTE-DUMMY LOAD switch (S1) to DUMMY LOAD.

(*d*) Perform the transceiver calibration procedure as outlined in *c* above, leaving these controls as indicated.

(*e*) Set the remaining transceiver controls as follows:

1. Emission switch to TUNE.

2. PA tuning switch to the white portion of the dial indicating the desired band.

3. METER switch to PLATE.

(*f*) Advance the MIC GAIN control fully clockwise and adjust the EXCITER TUNING control until maximum plate current is obtained on the meter.

(*g*) Adjust the PA TUNING control for a minimum (dip) indication on the meter.

(*h*) Set the MIC GAIN control fully counterclockwise.

(*i*) Set METER switch to GRID.

(*j*) Advance MIC GAIN control until a grid current indication is obtained on the meter.

(*k*) Adjust the EXCITER TUNING control to obtain a maximum (peak) grid current indication on the meter. It may be necessary to reduce MIC GAIN to keep meter reading on scale.

(*l*) Set MIC GAIN to OFF.

(*m*) Set EMISSION switch to LOCK.

(*n*) Advance the MIC GAIN control until a grid current reading approximately 1/3 of full scale is indicated on the meter.

(*o*) Set meter switch to PLATE.

(*p*) Alternately adjust the PA TUNING control and the PA INCR LOAD control until a meter indication of 230 ma is obtained at the minimum (dip) point with the PA tuning control. (When the transceiver is to be operated in conjunction with RF Amplifier AM-3979/FRC-93 (30L-1), adjust the controls for a meter indication of 200 ma at the minimum (dip) point.)

(*q*) On the C-6118/FRC-93 (312B-4), alternately change the wattmeter selector switch between 200 FORWARD and 200 REFLECTED. The meter should indicate 80 to 100 watts forward power and 0 to 10 watts reflected power. If not, repeat (*p*) above until these wattmeter indications are obtained.

(*r*) Set the MIC GAIN control to OFF and the EMISSION switch to LSB or USB as required.

(*s*) After the transceiver has been tuned, disconnect all cables to the dummy load and reconnect the equipment and antenna panels for normal operation.

(3) *Using linear RF Amplifier AM-3979/FRC-93* (30L-1). After performing the transceiver BIAS ADJUST, calibration, and tuning procedures outlined in *b* (1), (*c*), (*d*), and (*e*) above, set the controls of the AM-3979/FRC-93 as follows:

(*a*) Set ON-OFF switch to OFF.

(*b*) Set METER switch to TUNE.

(*c*) Set BAND switch to same band as that of the transceiver; LOADING control to 1 on the dial and TUNING control to white area for the band in use.

(*d*) Push the ON-OFF switch to ON.

(*e*) Set the transceiver MIC GAIN control to about the 75 percent point of its full range of adjustment.

(*f*) Alternately adjust the TUNING and LOADING controls on the AM-3979/FRC-93 to obtain a minimum (dip) indication at/or near, the zero (0) mark on the multimeter. (A minimum (dip) indication at the zero (0) mark, on the meter, will be obtained if the AM-3979/FRC-93 is properly tuned and loaded. The final adjustment for obtaining the minimum (dip) indication on the meter should be made with the TUNING control.)

NOTE

Once the equipment has been tuned on to a given frequency, the amplifier may be switched in or out of the circuit, as desired, by use of the ON-OFF switch. In the OFF position, a transfer relay in the AM-3979/FRC-93 couples the transceiver output to the antenna for normal operation.

(4) ***Using tuning unit TN-339*/GR (fig. 3-4).** The TN-339/GR is required for use with the AN/FRC-93 equipment when using a whip antenna below 20 MHz. To match the transceiver to the whip antenna, proceed as follows:

WARNING

> Extremely high rf voltages are present on the antenna tuning unit when the transmitter is in operation. Painful burns will result upon contact.

(a) Perform the mobile starting procedure (para 3-8b).

(b) Check to see that the proper crystals are installed in the transceiver (a above).

(c) Perform the transceiver calibration procedure (c above), leaving all transceiver controls as indicated.

(d) Perform the procedures given in (2) (e) through (n) above.

(e) Preset the TN-339/GR controls to the approximate settings for the operating frequency of the transceiver (Table 3-2).

(f) On the transceiver, set the METER switch to PLATE and alternately adjust the P.A. TUNING control for a minimum (dip) meter indication and the P.A. LOADING control for an increase in loading until a meter indication of 175 ma is obtained as the P.A. TUNING control is adjusted for a minimum (dip) meter indication.

(g) Set the C-6118/FRC-93 wattmeter switch to 200 REFLECTED and adjust the correct FREQUENCY control on the TN-339/GR for a minimum meter indication on the C-6118/FRC-93 WATTMETER.

(h) Readjust the transceiver P.A. TUNING and P.A. LOADING controls as in (f) above.

(i) Set the C-6118/FRC-93 wattmeter switch to 200 FORWARD and adjust the TN-339/GR COUPLING control for a maximum indication on the C-6118/FRC-93 wattmeter.

(j) Alternately adjust the controls listed below while switching the C-6118/FRC-93 wattmeter switch between 200 FORWARD and 200 REFLECTED. The wattmeter should indicate 80 to 100 watts forward power and 0 to 10 watts reflected power, with a transceiver plate current meter reading of approximately 230 ma.

1. TN-339/GR 2-10MC or 10-20MC FREQUENCY control.

2. TN-339/GR COUPLING Control.

3. Transceiver P.A. TUNING control.

4. Transceiver P.A. LOADING control.

(k) Set the transceiver MIC GAIN control to OFF and EMISSION switch to USB or LSB as required.

(l) Record the settings of the TN-339/GR controls for future use should it become necessary to return to this frequency.

(m) The approximate control settings for the tuning unit when used with the radio terminal set at frequencies below 20 MHz are given in Table 3-2 below.

NOTE

> The TN-339/GR can be used when operating at frequencies above 20 MHz by removing one or two of the MS-116A sections from the whip antenna to produce a quarter-wavelength antenna for frequency above 20 MHz.

Table 3-2. Tuning Unit Control Settings

Operating frequency (MHz)	*Range switch position*	*COUPLING control setting*	*Loading (FREQUENCY) control, 2 MHz to 20 MHz*
2.00	2-10	4.9	4.6
2.05	2-10	4.9	7.1
2.10	2-10	5.1	9.4
2.15	2-10	4.9	11.4
2.20	2-10	4.8	13.3
2.25	2-10	4.7	15.1
2.30	2-10	4.6	16.8
2.35	2-10	4.5	18.3
2.40	2-10	4.5	19.8
2.45	2-10	4.6	21.3
2.50	2-10	4.6	22.6
2.55	2-10	4.3	23.9
2.60	2-10	4.3	25.0
2.65	2-10	4.2	26.2
2.70	2-10	4.2	27.3
2.75	2-10	4.2	28.3
2.80	2-10	4.2	29.3
2.85	2-10	4.2	30.2

Table 3-2. Tuning Unit Control Settings—Continued

Operating frequency (MHz)	*Range switch position*	*COUPLING control setting*	*Loading (FREQUENCY) control, 2 MHz to 20 MHz*
2.90	2-10	4.5	31.0
2.95	2-10	4.1	32.0
3.00	2-10	4.1	32.7
3.05	2-10	4.1	33.5
3.10	2-10	4.1	34.2
3.15	2-10	4.2	35.0
3.20	2-10	4.2	35.6
3.25	2-10	4.3	36.3
3.30	2-10	4.3	37.0
3.35	2-10	4.5	37.5
3.40	2-10	4.5	38.2
3.45	2-10	4.3	38.7
3.50	2-10	4.2	38.9
3.55	2-10	4.1	39.5
3.60	2-10	4.0	39.9
3.65	2-10	4.0	40.4
3.70	2-10	4.0	40.9
3.75	2-10	4.1	41.3
3.80	2-10	4.1	41.7
3.85	2-10	4.1	42.2
3.90	2-10	4.1	42.5
3.95	2-10	4.2	42.9
4.00	2-10	4.2	43.2
4.05	2-10	4.0	43.7
4.10	2-10	4.0	44.0
4.15	2-10	3.9	44.3
4.20	2-10	3.8	44.6
4.25	2-10	3.8	44.9
4.30	2-10	3.6	45.2
4.35	2-10	3.4	45.5
4.40	2-10	3.4	45.8
4.45	2-10	3.1	46.1
4.50	2-10	2.9	46.2
4.55	2-10	2.9	46.4
4.60	2-10	2.8	46.7
4.65	2-10	2.8	46.9
4.70	2-10	2.8	47.2
4.75	2-10	2.8	47.4
4.80	2-10	2.7	47.6
4.85	2-10	2.7	47.9
4.90	2-10	2.7	48.1
4.95	2-10	2.7	48.3
5.00	2-10	2.7	48.5
5.05	2-10	2.7	48.7
5.10	2-10	2.7	48.9
5.15	2-10	2.6	49.1
5.20	2-10	2.6	49.3
5.25	2-10	2.6	49.5
5.30	2-10	2.5	49.6
5.35	2-10	2.5	49.8
5.40	2-10	2.5	50.0
5.45	2-10	2.5	50.1
5.50	2-10	2.5	50.4
5.55	2-10	2.5	50.5
5.60	2-10	2.5	50.7
5.65	2-10	2.4	50.9
5.70	2-10	2.3	50.9
5.75	2-10	2.3	51.0
5.80	2-10	2.3	51.2
5.85	2-10	2.3	51.3
5.90	2-10	2.3	51.4
5.95	2-10	2.3	51.5

Table 3-2. Tuning Unit Control Settings—Continued

Operating frequency [MHz]	*Range switch position*	*COUPLING control setting*	*Loading [FREQUENCY] control, / 2 MHz to 20 MHz*
6.00	2-10	2.3	51.7
6.05	2-10	2.3	51.9
6.10	2-10	2.3	51.9
6.15	2-10	2.3	52.0
6.20	2-10	2.3	52.2
6.25	2-10	2.3	52.3
6.30	2-10	2.2	52.5
6.35	2-10	2.2	52.5
6.40	2-10	2.2	52.7
6.50	2-10	2.2	53.0
6.60	2-10	2.1	53.1
6.70	2-10	2.0	53.4
6.80	2-10	2.0	53.6
6.90	2-10	2.0	53.7
7.00	2-10	1.9	54.0
7.10	2-10	1.8	54.2
7.20	2-10	1.8	54.4
7.30	2-10	1.8	54.5
7.40	2-10	1.8	54.7
7.50	2-10	1.7	54.9
7.60	2-10	1.7	55.1
7.70	2-10	1.6	55.2
7.80	2-10	1.6	55.4
7.90	2-10	1.6	55.5
8.00	2-10	1.6	55.7
8.10	2-10	1.5	55.7
8.20	2-10	1.5	55.9
8.30	2-10	1.5	56.1
8.40	2-10	1.5	56.1
8.50	2-10	1.5	56.2
8.60	2-10	1.5	56.4
8.70	2-10	1.5	56.5
8.80	2-10	1.5	56.7
8.90	2-10	1.5	56.8
9.00	2-10	1.5	57.1
9.10	2-10	1.5	57.3
9.20	2-10	1.5	57.4
9.30	2-10	1.5	57.5
9.40	2-10	1.5	57.7
9.50	2-10	1.5	57.7
9.60	2-10	1.5	57.8
9.70	2-10	1.5	58.0
9.80	2-10	1.4	58.3
9.90	2-10	1.4	58.4
10.00	2-10	1.4	58.5
10.00	10-20	1.1	2.5
10.10	10-20	1.1	2.7
10.20	10-20	1.1	3.0
10.30	10-20	1.1	3.4
10.40	10-20	1.1	3.7
10.50	10-20	1.1	4.0
10.60	10-20	1.1	4.5
10.70	10-20	1.1	4.7
10.80	10-20	1.1	5.0
10.90	10-20	1.1	5.3
11.00	10-20	1.1	5.7
11.10	10-20	1.2	5.8
11.20	10-20	1.2	6.1
11.30	10-20	1.2	6.5
11.40	10-20	1.2	6.7
11.50	10-20	1.2	7.0
11.60	10-20	1.2	7.1

Table 3-2. Tuning Unit Control Settings—Continued

Operating frequency [MHz]	*Range switch position*	*COUPLING control setting*	*Loading [FREQUENCY] control, 2 MHz to 20 MHz*
11.70	10-20	1.2	7.4
11.80	10-20	1.2	7.7
11.90	10-20	1.2	7.9
12.00	10-20	1.2	8.1
12.10	10-20	1.2	8.4
12.20	10-20	1.1	8.6
12.30	10-20	1.1	8.8
12.40	10-20	1.1	9.0
12.50	10-20	1.1	9.2
12.60	10-20	1.1	9.5
12.70	10-20	1.1	9.8
12.80	10-20	1.1	9.9
12.90	10-20	1.1	10.0
13.00	10-20	1.1	10.3
13.10	10-20	1.1	10.4
13.20	10-20	1.1	10.7
13.30	10-20	1.1	10.8
13.40	10-20	1.1	11.0
13.50	10-20	1.1	11.2
13.60	10-20	1.1	11.3
13.70	10-20	1.1	11.6
13.80	10-20	1.1	11.6
13.90	10-20	1.1	11.8
14.00	10-20	1.1	11.9
14.20	10-20	1.1	12.3
14.40	10-20	1.1	12.4
14.60	10-20	1.1	12.8
14.80	10-20	1.1	13.0
15.00	10-20	1.1	13.2
15.20	10-20	1.1	13.6
15.40	10-20	1.0	13.8
15.60	10-20	1.0	14.2
15.80	10-20	1.0	14.2
16.00	10-20	1.0	14.4
16.20	10-20	1.0	14.6
16.40	10-20	.9	14.7
16.60	10-20	.9	14.7
16.80	10-20	.8	14.9
17.00	10-20	.8	15.1
17.20	10-20	.8	15.4
17.40	10-20	.7	15.4
17.60	10-20	.5	15.6
17.80	10-20	.4	16.0
18.00	10-20	.4	16.3
18.20	10-20	.4	16.4
18.40	10-20	.4	16.7
18.60	10-20	.3	17.0
18.80	10-20	.3	17.2
19.00	10-20	.3	17.4
19.20	10-20	.3	17.6
19.40	10-20	.2	17.9
19.60	10-20	.2	18.3
19.80	10-20	.2	18.5
20.00	10-20	.1	18.7

Section III. OPERATIONAL PROCEDURES

WARNING

Before operating the equipment, make certain all the requirements of TB SIG 291 are met. Injury or DEATH could result from improper or careless operation.

3-10. Fixed Station Operation

a. Five equipment operating positions are provided for fixed station operation. Each position is powered from an ac source. The operation of each position is identical.

b. Before operating any of the equipment positions, check to see that:

(1) Doublet antennas are properly constructed and connected (para 2-6).

(2) Fixed station starting procedure has been performed (para 3-8*a*).

(3) Transceiver preoperational procedures have been performed (para 3-9).

(4) Insure that all necessary circuit breakers (para 3-8) are set to ON.

(5) Set the 110VAC-28VDC selector switch (fig. 3-3) at positions 1 and 2 to 110VAC.

c. Operate the equipment position as follows:

(1) Set the C-6118/FRC-93 wattmeter switch to 200 FORWARD, FUNCTION switch to NORMAL, and PHONE PATCH switch to OFF.

(2) Plug the microphone into the C-6118/FRC-93 MIC jack.

(3) If required, plug the headset into the transceiver PHONES jack.

(4) Set the transceiver OFF-ON-NB-CAL switch to ON, METER switch to ALC, EMISSION switch to USB or LSB as required, and RF GAIN control fully clockwise.

(5) Adjust the transceiver A.F. GAIN control to produce the desired volume level in the C-6118/FRC-93 loudspeaker or in the headset.

(6) To transmit, depress the microphone push-to-talk switch and, while counting into the microphone in a normal manner, adjust the transceiver MIC GAIN control for an average meter indication of S6 and an rf output indication of 80 to 100 watts on the C-6118/FRC-93 wattmeter.

(7) The equipment is now prepared to permit communication between the shelter and a distant station.

d. If RF Amplifier AM-3979/FRC-93 (30L-1) is to be used with the equipment at a particular position, the following procedures should be performed:

(1) Set the switch on the amplifier input selector box (fig. 3-5) to the position selected to be used.

NOTE

If position 1 or 2 selected for use with the amplifier, the ANT-WHIP selector switch *must* be at ANT.

(2) Connect rf cable assembly RF2-2 to Dummy Load DA-412A/U (BIRD Model 8401) (fig. 1-11). (Dummy Load DA-412A/U must be used in conjunction with the AM-3979/FRC-93.)

(3) Set Directional Wattmeter 302C-3 (fig. 3-6) function switch to the 2000 FORWARD Position.

(4) Final tune the amplifier (para 3-9*d*(3)).

(5) Disconnect rf cable assembly RF2-2 from the dummy load.

(6) At the antenna panel in the shelter, disconnect the rf cable for the position selected for use with the AM-3979/FRC-93 and connect rf cable assembly RF2-2 to this connector. (Refer to the chart in paragraph 3-9*d*(1) (*c*)).

(7) The equipment at the selected position can now be operated on increased power to extend range of the transmitter.

3-11. Mobile Operation

a. Positions 1 and 2 are capable of operation under mobile conditions, as well as fixed station conditions. In the mobile mode, the equipments at these positions are powered by their own dc power supplies PP-4765/GRC-159(V) (fig. 1-6), which are themselves powered from the carrying vehicle battery.

b. Before operating the equipment at positions 1 or 2:

(1) Perform the mobile starting procedures (para 3-8*b*).

(2) Perform the transceiver preoperational procedures (para 3-9).

c. Operate the equipment following the procedures outlined in paragraph 3-10*c*.

3-12. Remote Operation

All the equipment positions can be operated from a remote site located up to 1500 feet from the shelter, using the remote control console (fig. 3-7). In addition, the audio output of all five equipment positions in the radio terminal set can be monitored simultaneously at the remote site.

a. Connect the remote control console as outlined in paragraph 2-9*c*.

b. Connect Telephone Set TA-312/PT, located on the console, to the order-wire circuit by inserting a short length of hookup wire between the TA-312/PT binding posts and the ORDER WIRE binding posts mounted on the remote control console.

NOTE

To apply to the remote control console, the DC SUP circuit breaker on the AC POWER DISTRIBUTION PANEL and the REMOTE circuit breaker on the dc power distribution panel must both be at ON.

c. Operate any of the equipment positions in the shelter, from the remote site, as follows:

(1) Set up the radio terminal set for normal fixed station operation (para 3–10).

(2) At the remote control console, crank the magneto of the TA–312/PT to establish two-way telephone contact between the remote site and the shelter.

(3) After telephone contact has been established, the following functions should be performed in coordination with the shelter operator.

(*a*) Request the shelter operator to tune all the receivers to a frequency where no signal is being received and to adjust the RF and AUDIO gain controls on each receiver for background noise (hissing) normally heard during receiver operation.

(*b*) Instruct the shelter operator to turn the light control adjustment potentiometer (CH–1 thru CH–5 ADJ), located in the AC POWER AND SIGNAL ENTRANCE BOX (fig. 1–7), to their maximum clockwise setting. (A slight drag will be felt and a faint click may be heard when the extreme cw or ccw points are reached. The potentiometers have an adjustment range of approximately 25 turns.)

(*c*) Starting with position 1, instruct the shelter operator to switch the transceiver OFF-ON-CAL-NB control to CAL and to tune it for a loud heterodyne signal at the nearest 100—kHz mark (0–100–200). Next, instruct the shelter operator to turn the CH–1 ADJ counterclockwise until he sees the CHAN 1 call light on the remote control console ignite. Immediately inform the shelter operator when this happens so that he will cease further adjustment.

(*d*) Next, request the shelter operator to switch the OFF-ON-CAL-NB control of receiver 1 to ON. The call light on the remote control console should remain lighted for approximately 8 seconds ±2 seconds, due to loss of the heterodyne signal.

(*e*) If the call light does not remain lighted for the time period, instruct the shelter operator to slightly vary the CH–1 ADJ clockwise until the condition of (*d*) above is met. (The call lights are a visual means of alerting the remote control console operator to the reception of an incoming signal at the position so indicated.)

(4) Perform (3) (*c*) and (*d*) above for each of the remaining four positions (channels).

d. To use Microphone M–127/FRC–93, insert the microphone plug into the MICROPHONE jack located on the right front panel of the console (fig. 3–7).

e. To use Handset H–60/PT, connect the handset connector plug to J111 on the left front panel of the console and secure the handset on the holder provided (fig. 3–7).

f. When using the microphone or the handset, use a small screwdriver to adjust the MIKE (microphone) or the PHONE (handset) controls on the rear panel of the remote control console to increase the output of these instruments to a desirable level of modulation as indicated on the output meter of the RT–718/FRC–93. Set the SIDETONE control to produce a comfortable sidetone level while talking in the handset.

g. To use Headset H–113/U, insert headset plug into either the left- or right-hand jack on the front of the console. (Refer to paragraph 3–7 to determine jack usage.)

h. If a signal is received at the remote control console, set the HANDSET XMT-MONITOR-MIC XMT selector switch to the position desired for listening to and answering the incoming signal. (This will largely depend upon operating conditions at the remote site.) Adjust the remote control console VOLUME control to the level desired for speaker and/or headset operation.

3–13. Operation Under Unusual Conditions

The AN/TRC–133A is fully insulated and weatherproofed for operation in hot, cold, or moderate climates. The shelter facility provides protection from the elements for both the personnel and the equipment; however, under extreme conditions, the following precautions are necessary.

a. Cold Climates. Extreme cold causes cables and wires to become hard, brittle, and difficult to handle. Be careful when handling the cables and connecting them to the shelter entrance panels so that kinks and unnecessary loops will not result in permanent damage. Try to fasten the cables to some support above ground, if possible, in order to prevent the cables from freezing solid to the ground. Make sure that the binding posts and the connectors in the entrance boxes are free of frost, snow, and ice. Replace the covers on the receptacles, and close the entrance box covers when they are not in use. Replace the connector cover as soon as a cable is disconnected. Never drag or place an open connector in the snow.

b. Hot Climates. In hot, dry climates, connectors, receptacles, and binding posts are subject to damage from dust and dirt. Replace the covers on th connectors and the receptacles, and close the covers on entrance boxes when the entrance boxes are open. Never place an open connector on the ground.

c. Warm, Damp Climates. In warm, damp climates, the equipment is subject to damage from moisture and fungi. Wipe all moisture and fungi from the equipment with a lint free cloth.

3-14. Stopping Procedures

a. To shut the radio terminal set down, turn off all equipment with individual power ON-OFF switches before operating the associated circuit breakers in the AC POWER DISTRIBUTION PANEL and the dc power distribution panel.

b. In an emergency, flip the MAIN circuit breaker on the AC POWER DISTRIBUTION PANEL or the dc power distribution panel to OFF, as applicable.

c. Shut down the power unit, using procedures in the applicable technical manual (appx A).

3-15. Operation Under Emergency Conditions

In the event there is a partial power failure that is only reduced, ac power can be used. The operators should keep in mind that each of the electric heaters consumes approximately 1500 watts of power. Each of the five transceivers (all operating on the receive function) consumes 235 watts or a total of 1175 watts. If all five transceivers are transmitting at one time, they consume a total of 2375 watts, twice the power required for the receive function. If the rf amplifier is used, there will be an additional 1725 watts of power used. The type and amount of operation performed under emergency conditions will depend upon the amount of reduced power available.

3-16. Recognition and Identification of Jamming

Under real or simulated tactical conditions, the transceivers (in the receive function) might be jammed by the enemy. Enemy jamming is used to make it difficult or impossible to hear a desired signal. Unusual noises or strong interference heard on the receiver may be enemy jamming, signals from a friendly station, noise from a local source, or the transceiver may be defective. To determine whether or not the interference is originating in the transceiver, disconnect the antenna. If the interference *continues*, the transceiver is defective. Enemy jamming signals may be classified as *continuous wave* or *modulated*. A jamming signal may be intended to block a single frequency. This is called *spot* jamming. The enemy may use one or several transmitters to jam a block or band of frequencies. This method is called *barrage* jamming.

a. Continuous-Wave Jamming. Cw jamming is transmitted as a steady carrier. This signal beats with another signal and produces a steady tone in the headset. Cw jamming signals may also be keyed by using a random on and off signal or using actual code characters keyed at the same rate or a little faster than the signal being received.

b. Modulated Jamming. Modulated jamming signals may consist of noise, laughter, singing, music, various tones, or most any unusual sound, or it may be a combination of these sounds. Various types of modulated jamming signals are explained below.

(1) *Spark.* This is one of the simplest, most effective, and most easily produced jamming signal. This type of signal sounds very rough, raspy, and sometimes like an electric motor with sparking brushes running. This type of signal is very broad; therefore, it will interfere with a large number of communication channels.

(2) *Sweep-through.* This signal is the result of sweeping or moving a carrier back and forth across your frequency at a slow or rapid rate. The numerous signals of varying amplitude and frequency produce a sound like that of a low-flying airplane passing overhead. This type of jamming is effective over a broad range of frequencies. When it is varied rapidly, it is effective against all types of voice signals.

(3) *Stepped tones or bagpipes.* This signal usually consists of several separate tones. The tones are transmitted in the order of first increasing and then decreasing pitch, repeated over and over. The audible effect is like the sound of a Scottish bagpipe.

(4) *Noise.* Noise is random both in amplitude and frequency. It is considered one of the better types of jamming modulation. It produces a sound similar to that head when a receiver is not tuned to a station and the volume or gain control is turned to maximum.

(5) *Gulls.* This signal consists of a quick rise and slow fall of a variable audiofrequency. The sound is similar to the cry of the sea gull.

3-17. Antijamming

When it is known that a receiver is being jammed, the operator will notify the immediate superior officer immediately and continue to operate the equipment. To provide maximum intelligibility of jammed signals, follow the operational procedure below:

a. Operate the transceiver as outlined in paragraphs 3-9 through 3-11 and in TM 11-5820-529-15.

b. Vary the RF GAIN control. This may reduce the jamming signal enough to permit the weaker signal to be heard.

c. Vary the AUDIO GAIN control. The level of the desired signal may be raised enough to be heard.

d. Detune the transceiver tuning dial several degrees on either side of the desired signal. This may cause some separation of the desired signal and the jamming signal. Remember that this detuning also changes the frequency of the transceiver's transmitter circuits.

e. If the above procedures do not provide sufficient signal separation for operation, report this to your immediate superior officer for consideration of changing to an alternate frequency and alternate call sign.

3-18. Preparation for Movement

To prepare the AN/TRC-133A for vehicular movement, follow the steps listed in *a* through *g* below:

a. Shut the fixed position operation down (para 3-14).

b. Prepare the equipment for mobile operation (para 3-8*b*).

WARNING

Do not attempt to disconnect any power or ground connection while power is running. Personnel may be exposed to 115 volts at high current.

c. Disconnect the ac power and remote cable connections (fig. 1-7) and reel up the power and remote cables.

d. Disconnect the ground strap from the ground terminal, remove the ground rod, and stow the ground strap and ground rod in the shelter.

e. Replace the covers on all the connectors on the ac power and signal entrance panel. Close the cover of the panel and fasten in place with the four latches.

f. Disconnect the doublet antenna cables from the connectors on the antenna entrance panel (B, fig. 1-8). Replace the covers on all the connectors on the antenna entrance panel.

g. Take down the doublet antennas as outlined in (1) through (5) below:

(1) Untie the ropes of Halyards MS-516(*)/GRA-14 from the antenna masts and lower the antenna wire to the ground.

(2) Disconnect the antenna wire from halyards, and from the antenna cable coaxial Y-connector (fig. 2-5).

(3) Carefully coil up the two sections of antenna wire. Tag the coil with the frequencies the wires are cut for. Do not kink the wire.

(4) Reel up the coaxial cable.

(5) Two men are required to take down the antenna mast as outlined in (a) through (e) below:

(a) Release the tension on the guys slightly.

(b) Number one man stands at foot of mast.

(c) Number two man removes the three guys from the front stake (fig. 2-9). He holds the guys and walks slowly toward the base of the mast. Simultaneously, number one man walks slowly away from the mast base, lowering the mast as he walks.

(d) After the mast has been lowered to the ground, remove the halyards and the guys from the mast and disassemble the mast.

(e) Repack Mast AB-155A/U in its canvas case and restow it in the shelter (fig. 1-6).

CHAPTER 4
MAINTENANCE

Section I. OPERATOR'S/CREW AND ORGANIZATIONAL MAINTENANCE

4-1. Scope of Operator's/Crew and Organizational Maintenance

a. Operator's/Crew preventive maintenance is the systematic care, servicing, and inspection of equipment to prevent the occurance of trouble, to reduce downtime, and to maintain the equipment in serviceable condition. To be sure that your Radio Terminal Set AN/TRC-133 is always ready for your mission, you must do scheduled PREVENTIVE MAINTENANCE CHECKS AND SERVICES (PMCS).

(1) BEFORE OPERATION, perform your B PMCS to be sure that your equipment is ready to go.

(2) DURING OPERATION, perform your D PMCS. This should help you spot small troubles before they become big problems.

(3) AFTER OPERATION, perform your A PMCS. This should help you keep your equipment in top shape.

(4) WEEKLY AND MONTHLY PMCS are important checks you make to keep serious problems from suddenly happening. Perform WEEKLY as well as BEFORE OPERATION PMCS if:

(a) You are assigned operator and have not operated the item since the last WEEKLY.

(b) You are operating the item for the first time.

(5) When an item of equipment is reinstalled after removal for any reason, perform the necessary B PMCS, paragraph 4-3, to be sure the item meets the readiness reporting criteria.

(6) Use the ITEM NO. column in the PMCS table to get the number to be used in the TM ITEM NO. column on DA Form 2404 (Equipment Inspection and Maintenance Worksheet) when you fill out the form.

b. Organizational preventive maintenance procedures are designed to help maintain equipment in serviceable condition. They include what items should be checked and how to check them. These checks and services described in paragraph 4-4, outline inspections that are to be made at specific (W) weekly, (M) monthly, (Q) quarterly, (S) semiannually, and (A) annual intervals.

c. Routine checks like CLEANING, DUSTING, WASHING, CHECKING FOR FRAYED CABLES, STOWING ITEMS NOT IN USE, COVERING UNUSED RECEPTACLES AND CHECKING FOR LOOSE NUTS AND BOLTS are not listed as PMCS checks. They are things that you should do anytime you see they must be done. If you find a routine check like one of those listed, in your PMCS, it was listed because other operators reported problems with this item.

WARNINGS

Never operate the generator or shelter until it has been properly grounded. Electrical defects in the load lines or equipment can cause death by electrocution when contact is made with an ungrounded system.

Adequate ventilation should be provided while using TRICHLOROTRIFLUOROETHANE. Prolonged breathing of vapor should be avoided. The solvent should not be used near heat or open flame; the products of decomposition are toxic and irritating. Since TRICHLOROTRIFLUOROETHANE dissolves natural oils, prolonged contact with skin should be avoided. When necessary, use gloves which the solvent cannot penetrate. If the solvent is taken internally, consult a physician immediately.

Compressed air is dangerous and can cause serious bodily harm if protective means or methods are not observed to prevent a chip or particle (of whatever size) from being blown into the eyes or unbroken skin of the operator or other personnel. Compressed air shall not be used for cleaning purposes except where reduced to less than 29 p.s.i. and then only with effective chip guarding and personal protective equipment. Do not use compressed air to dry parts when TRICHLOROTRIFLUOROETHANE has been used.

Safety precautions must be observed when installing *(erecting)* and using the Doublet Antenna. DEATH can easily occur if the Mast AB-155(T)/U comes in contact with electric power lines.

Prior to installation *(erection)* of this antenna, survey the area carefully for location of powerlines, their height above the ground level, and their proximity to the installation site. The Doublet Antenna must be installed as far away as possible from electric powerlines, but never closer than twice its height.

The Mast AB-155(*)/U is 40 feet tall, so it should never be installed (*erected*) closer than 80 feet from the base of the nearest powerlines.

NOTES

The PROCEDURES column in your PMCS charts instruct you how to perform the required checks and services. Carefully follow these instructions and if tools are needed or the chart instructions tell you, get organizational maintenance to do the necessary work.

If your equipment must be in operation all the time, check those items that can be checked and serviced without disturbing operation. Make the complete checks and services when the equipment can be shut down.

d. Deficiencies that cannot be corrected must be reported to higher category maintenance personnel. Records and reports of preventive maintenance must be made in accordance with procedures given in TM 38-750.

4-2. Materials Required for Operator's Maintenance

a. Lint-free cloth.

b. Cleaning fluid (Freon PCA, NSN 6850-00-984-5853).

c. Brush MIL-G-7241.

4-3. Operator's/Crew Preventive Maintenance Checks and Services, Radio Terminal Set AN/TRC-133(*)

NOTES

The checks in the interval column are to be performed in the order listed.

B — Before Operation
D — During Operation
A — After Operation
W — Weekly
M — Monthly

Item No.	Interval					Item to be inspected	Procedures. Check and have repaired or adjusted as necessary	For readiness reporting equipment is not ready/available if:
	B	D	A	W	M			
1.				•		Radio Terminal Set AN/TRC-133A		
a.				•		Fuses	Be sure all fuses are of proper value and that they are properly seated.	
b.				•		Antennas	Be sure all antennas are securely mounted and in good condition; check guy wires, if used, for corrosion and proper tension.	If antennas are improperly guyed, or if guys are defective.
c.				•		Cables and cords	Inspect all cables and cords for cracking, fraying and breaks.	If power cords are damaged to the extent that there is a fire hazard.
2.		•				Dc Power Supplies: Collins Model 516E-2, Power Mate Model RB23-6.0	Output voltage within tolerance.	Failure to maintain output voltage under load.
a.				•		Exterior surfaces	Clean exterior surfaces. Remove any dirt, fungus, grease, and moisture from exposed surfaces.	
b.				•		Cable connectors	Check cable connectors for tightness.	Connectors cannot be tightened.
c.				•		General condition	Inspect for breaks, cracks, cut or frayed cords, and loose connections.	Insulation anywhere on cables or wiring is sufficiently damaged to create a fire hazard.
						Remote Control Console. End item equipment	Check for completeness and general condition of equipment.	
b.				•		Controls, knobs, and switches	While making operating checks (item 4), observe that mechanical action of each control and switch is smooth, free of internal binding, and that there is no excessive looseness.	
c.		•		•		Operation	Operate equipment in accordance with operating instructions. Be alert for any unusual indication or condition.	Console wiring catches fire.

Item No.	Interval B	D	A	W	M	Item to be inspected	Procedures. Check and have repaired or adjusted as necessary	For readiness reporting equipment is not ready/ available if:
4.						Radio Frequency Tuner TN-339/GR.		
a.				•		End item equipment	Check for completeness and general condition of equipment.	
b.				•		Exterrior surfaces	Clean exterior surfaces including front panel. Check meter glass for cracks or breakage.	
c.				•		Controls, knobs, and switches.	While making operating checks (item 4), observe that mechanical action of each control and switch is smooth, free of internal binding, and that there is no excessive looseness.	
d.				•		Operation	Operate equipment in accordance with operating instructions. Be alert for any unusual indication or condition.	
5.						RF Amplifier AM-3979/ FRC-93.		
a.				•		End item equipment	Check for completeness of equipment.	
b.				•		Exterior or surfaces	Clean exterior surfaces, including panel and meter glass. Check meter glass. Check meter glass and indicator lens for cracks.	
c.				•		Connectors	Check tightness of all connectors.	Rf connectors to antenna are damaged.
d.				•		Controls and indicators	While making operating checks (item 5), observe that mechanical action of each knob, dial, and switch is smooth and free of external or internal binding, and that there is no excessive looseness. Also check meter for sticking or bent pointer.	
				•		Operation	Operate equipment according to referenced technical manual. During operation, be alert for any unusual signs or conditions.	Final tank circuit begins to smoke or melt from excessive heat. VSWR will show very high.
9.						Control, Radio Set C-6118/ FRC-93.		
a.	•			•		End item equipment	Inspect equipment for completeness.	Loudspeaker fails to produce intelligible audio when the transceiver is operating normally and all else is correct. NOTE This does not apply to CW or teletype operation if used.
b.				•		Exterior surfaces	Clean exterior surfaces, including panel. Check glass on meter and frequency indicator for cracks.	
c.				•		Cable connectors	Check cable connectors for tightness.	
d.				•		Controls, knobs, and switches	While making operating checks (item 5), observe that mechanical action of each control and switch is smooth, free of internal binding, and that there is no excessive looseness.	
e.		•		•		Operation	Operate equipment in accordance with operating instructions. During operation, be alert for any unusual signs or conditions.	
6.						Transceiver RT-718/FRC-93 and Power Supply PP-4151 FRC-93.		
a.		•		•		End item equipment	Check for completeness of equipment.	RT-718/FRC has missing or damaged crystals.

Item No.	Interval B	Interval D	Interval A	Interval W	Interval M	Item to be inspected	Procedures, Check and have repaired or adjusted as necessary	For readiness reporting equipment is not ready/available if:
b.	•	•		•		Exterior surfaces	Clean exterior surfaces including panel. Check glass on meter and frequency indicator for cracks.	
c.		•		•		Controls, knobs, and switches	While making operating checks (item 4), observe that mechanical action of each control and switch is smooth and free of external or internal binding, and that there is no excessive looseness.	
d.		•		•		Operation	Operate equipment in accordance with operating instructions. During operation, be alert for any unusual signs or conditions.	Transceiver operates on the incorrect frequency when proper crystal and tuning is used.
8.						Microphone M-127/FRC-93		
a.		•		•		Operation	Check for normal operation and complete functional response. Check for positive mechanical action of push-to-talk switch.	
b.				•		General condition	Inspect for breaks, cracks, and loose or broken parts, and loose connections.	
c.				•		Cord	Inspect cord for cuts, breaks, fraying and deterioration.	

4-4. Organizational Preventive Maintenance Checks and Services

NOTE

The checks in the interval column are to be performed in the order listed.

W - Weekly
M - Monthly
Q - Quarterly
S - Semiannually
A - Annually

Item No.	Interval W	Interval M	Interval Q	Interval S	Item to be Inspected	Procedures
1.			•		Fire extinguisher	Check for proper weight, charge, or broken seal.
2.			•		First aid kit	See that kit contains all items as prescribed. Replenish as necessary.
			•		Calibration of all supporting test equipment.	See that calibration records are correct for test equipment.

4-5. Cleaning and Touchup Painting

Inspect the interior surfaces of the shelter and the exterior surfaces of the electronic equipment. The shelter and electronic equipment should be free of dust, dirt, grease, and fungus. To clean the shelter and the equipment, proceed as follows:

a. Sprinkle enough water on the floor to prevent dust from rising; sweep the floor.

b. Remove dust and loose dirt from walls and ceiling of the shelter and from exterior surfaces of equipment with a clean, soft cloth.

WARNING

Adequate ventilation should be provided while using TRICHLOROTRIFLUOROETHANE. Prolonged breathing of vapor should be avoided. The solvent should not be used near heat or open flame; the products of decomposition are toxic and irritating. Since TRICHLOROTRIFLUOROETHANE dissolves natural oils, prolonged contact with skin should be avoided. When necessary, use gloves which the solvent cannot penetrate. If the solvent is taken internally, consult a physician immediately.

c. Remove grease, fungus, and ground-in-dirt with a cloth dampened (not wet) with cleaning fluid (TRICHLOROTRIFLUOROETHANE, NSN 6850-00-984-5853).

d. Remove dust or dirt from plugs and jacks with a brush.

e. Clean the equipment front panels, meters, and control knobs with a soft, clean cloth. If necessary, dampen the cloth with a solution of water and mild soap.

f. Remove rust and corrosion from metal surfaces by lightly sanding them with fine sandpaper. Brush two thin coats of paint on the bare metal to protect it from further corrosion. Refer to the applicable cleaning and refinishing practices specified in TB 43-0118.

4-6. Organizational Troubleshooting

a. Whenever an equipment trouble occurs, make a visual inspection of all equipment panels, controls, and cabling before performing any detailed troubleshooting procedures. The following visual checks should be made by operating personnel when attempting to determine the cause of the equipment trouble.

(1) Check for blown-fuse indications.

(2) Check panel meters for proper indications.

(3) Check equipment controls for proper setting.

(4) Check for tripped circuit breakers at the power distribution panels.

(5) Check the patch cords for proper circuit terminations.

(6) Check the equipment power and signal cord plugs for full insertion into their associated receptacle or jack.

(7) Perform other checks as indicated in the equipment technical manuals (app A).

b. Organizational maintenance personnel should perform the following additional troubleshooting checks:

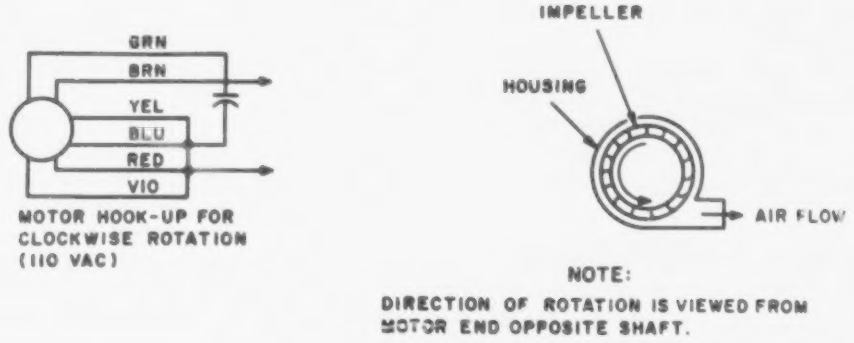
(1) Check the appropriate signal circuit or ac power circuit in the shelter to determine if the trouble is in the shelter circuits or in the equipment. Substitute an unused equipment, whenever possible, for a suspected defective equipment.

(2) When trouble has been localized to a specific component, refer to the applicable equipment manual (app A). If the equipment defect cannot be isolated and repaired, refer it to a higher category maintenance activity.

(3) Refer to troubleshooting charts (c through f below).

c. AC Power Distribution Panel, Troubleshooting Chart.

Item No.	*Symptom*	*Possible trouble*	*Corrective measures*
1	Main power lamp fails to light and voltmeter indicates zero with power source connected to shelter and the MAIN circuit breaker at ON.	*a.* Open MAIN circuit breaker.	*a.* Check circuit breaker and make sure it is at ON. If circuit breaker has tripped, reset it *once* to ON. If circuit breaker retrips, refer to higher category of maintenance.
		b. Defective power source or disconnected power cable.	*b.* Check power source and connection to shelter (para 2-8).
2	Main power lamp lights but voltmeter indicates zero.	Defective voltmeter.	Refer to higher category of maintenance.
3	Main power lamp fails to light and voltmeter indicates 115 VAC.	Defective neon lamp.	Replace defective lamp.
4	One or more of the power-on indicators on the AC POWER DISTRIBUTION PANEL fail to light when its circuit breaker is set to ON.	Defective neon lamp or open circuit breaker.	Check equipment on the individual line (for example, HTR 1). Determine if equipment is receiving power. If equipment is receiving power, replace defective neon lamp. If equipment on the individual line is not receiving power, the circuit breaker is open. Reset circuit breaker to ON. If circuit breaker is tripped again to OFF, refer to higher category of maintenance.
5	All the power-on indicators light but some of the equipment in shelter inoperative.	Open circuit between AC POWER DISTRIBUTION PANEL and equipment or faulty equipment.	Check equipment on the individual line. Determine if equipment is receiving power. If equipment is receiving power, refer to equipment technical manual (App A). If equipment is not receiving power, refer to higher category of maintenance. If BLO indicator lights and the exhaust blower (fig. 1-6) is inoperative, refer to higher category of maintenance.


GRN
BRN
YEL
BLU
RED
VIO
MOTOR HOOK-UP FOR CLOCKWISE ROTATION (110 VAC)
IMPELLER
HOUSING
AIR FLOW
NOTE:
DIRECTION OF ROTATION IS VIEWED FROM MOTOR END OPPOSITE SHAFT.

EL5820-610-14-TM-81

Figure 4-1. Exhaust blower, wiring diagram.

WARNING
RADIATION HAZARD

The voltmeter in the dc power distribution panel contains radioactive material. Do not open this meter or attempt to repair it. Refer to AR 755-15 before attempting to dispose of this meter.

d. Dc Power Distribution Panel, Troubleshooting Chart.

Item No.	*Symptom*	*Possible trouble*	*Corrective measures*
1	MAIN indicator lamp fails to light and voltmeter indicates zero with dc power being applied from the vehicle.	*a.* Open MAIN circuit breaker.	*a.* Check circuit breaker by pushing to reset *once.* If circuit breaker retrips, refer to higher category of maintenance.
		b. Defective vehicle power source or disconnected power cable.	*b.* Check vehicle power source and power connection between vehicle and shelter (para 2-8).
2	MAIN power lamp lights but voltmeter indicates zero.	Defective voltmeter.	Refer to higher category of maintenance.
3	MAIN power lamp fails to light and voltmeter indicates a dc voltage present.	Defective neon lamp.	Replace defective lamp.
4	POS-1, POS-2, LIGHT, FAN indicators fail to light.	Defective neon lamp or open circuit breaker or circuit.	Check equipment on the individual line (for example (FAN)). Determine if equipment is receiving power. If equipment is receiving power, replace defective neon lamp. If equipment on the individual line is not receiving power, the circuit breaker is open. Push to reset circuit breaker. If circuit breaker is tripped again to off, refer to higher category of maintenance.

e. Remote Control Console, Troubleshooting Chart.

Item No.	*Symptom*	*Possible trouble*	*Corrective measure*
1	Call lights on the remote console do not light when a signal is being received on channel.	*a.* The channel light control adjustment potentiometer not adjusted correctly.	*a.* Readjust the channel potentiometer (para 3-12).
		b. Defective neon lamp.	*b.* Replace neon lamp.
2	Microphone on the remote console not modulating the RT-718/FRC.	Microphone output not adjusted correctly.	Readjust microphone output (para 3-12*f*).

Item No.	*Symptom*	*Possible trouble*	*Corrective measure*
3	Remote console inoperative.	*a.* Open remote cable.	*a.* Check cable through order wire circuit (*b* of para 3-12).
		b. Open power circuit.	*b.* Check the DC SUP circuit breaker on the AC POWER DISTRIBUTION PANEL and the REMOTE circuit breaker on the dc power distribution panel. Both must be at ON. Check cable connections of 24 VDC REG. power supply (RB236.0) (fig. 1-11).

f. System Troubleshooting Chart.

Item No.	*Symptom*	*Possible trouble*	*Corrective measures*
1	No received signal on one of the transceivers.	*a.* Faulty headset.	*a.* Exchange headset.
		b. Faulty transceiver tuning.	*b.* Precalibrate and retune transceiver (para 3-9*c*).
		c. Faulty antenna circuit.	*c.* For transceivers at position 1 or 2, if set is on doublet, switch to ship antenna. If signal is picked up, doublet is at fault. WARNING Before proceeding with the next troubleshooting step, make sure that none of the transceivers are transmitting. High rf voltages exist on the antenna connectors while the tranceivers are transmitting. For transcivers at position 3, 4, and 5, check antenna and antenna lead-in at the doublet antenna connector (B, fig. 1-8).
		d. Faulty transceiver.	*d.* Perform steps 1 through 3 above; then, if still unable to pick up signal, refer to higher category of maintenance.
2	Distant station unable to pick up signal from	*a.* Transceiver may require retuning.	*a.* Retune transceiver (para 3-9*d*).
		b. Distance and frequency assigned may require use of RF Amplifier AM-3979/FRC-93.	*b.* Tune and use RF Amplifier AM-3979/FRC-93 (para 3-9*d*).
3	On RF Amplifier AM3979/FRC-93, zero reading not indicated on MULTIMETER when MULTIMETER SWITCH set at TUNE.	Changing frequency requires retuning of the rf amplifier.	Retune rf amplifier (para 3-10*d*). Switch rf amplifier by using the amplifier input selector switch to one of the other transceivers, and retune the rf amplifier to that transceiver frequency. If zero reading still not read on rf amplifier MULTIMETER, refer to higher category of maintenance

Section II. DIRECT SUPPORT MAINTENANCE

NOTE

Refer to paragraph 4-6c for the Direct Support Electrical Test for the shelter and remote control. Refer to appendices A and C for maintenance data covering individual equipment.

4-7. General

a. Direct support maintenance is required for the equipment components of the radio terminal set as described in the applicable technical manual covering the equipment (app A). Direct support maintenance includes all organizational maintenance procedures and is performed only by those personnel who have the training required to perform such maintenance.

b. Included in the full range of direct support maintenance is repair and replacement of all interconnecting cables, removal and replacement of all depot fabricated components, and removal and replacement of the printed circuit boards.

4-8. Direct Support Troubleshooting

a. Direct support troubleshooting for the AN/TRC-133A consists of determining which end items, modules, or components that are allocated for replacement at Direct Support maintenance are at fault. The troubleshooting charts in *e* and *f* below should be used to localize and isolate the faults after an observation of the equipment operation has sectionalized the trouble to the audio or rf areas.

b. The schematic diagrams that are required by the repair technician to troubleshoot the equipment covered in this manual are listed in (1) through (10) below.

(1) *Figure 4-1*. Exhaust blower, wiring diagram.

(2) *Figure 4-2*. Signal light control, schematic diagram.

(3) *Figure 4-3*. Rf switching relays, schematic diagram.

(4) *Figure 4-4*. 110VAC-28VDC selector switch, schematic diagram.

(5) *Figure 4-5*. 24-volt regulated dc power supply (RB 23-6.0), schematic diagram.

(6) *Figure 4-6*. Dc power distribution panel, schematic diagram.

(7) *Figure 4-7*. Remote control cable, schematic diagram.

(8) *Figure FO-2*. Remote control console, schematic diagram.

(9) *Figure FO-3*. Ac power and signal entrance box, schematic diagram.

(10) *Figure FO-4*. Rf amplifier input selector, schematic diagram.

c. The interconnection diagrams that are required by the repairman to trace control, signal, and power troubles are listed in (1) through (4) below:

(1) *Figure FO-5*. Ac power distribution diagram.

(2) *Figure FO-6*. Signal light control, printed circuit wiring.

(3) *Figure FO-7*. Rf cabling diagram.

(4) *Figure FO-8*. Audio and control circuits wiring diagram.

d. The following tools and test equipment are required for Direct Support Maintenance.

(1) Multimeter TS-352B/V or equivalent.

(2) Multimeter ME-26D/U or equivalent.

(3) Audio Signal Generator O-1025/U or equivalent.

(4) Oscilloscope AN/USM-140A/U or equivalent.

(5) Tool Kit, Electronic Equipment TK-105/G or equivalent.

e. Audio Circuits, Troubleshooting.

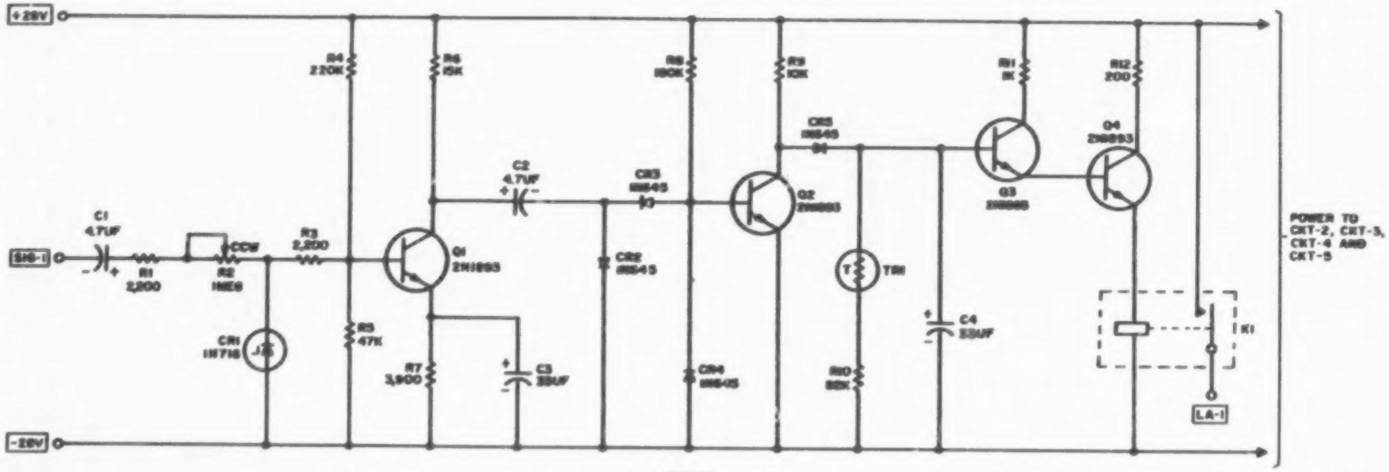
Item No.	*Symptom*	*Possible trouble*	*Corrective measures*
1	Remote operating channels on remote control console will function with the handset but not with the microphone.	*a*. Microphone.	*a*. Check and replace microphone.
		b. Microphone amplifier A4.	*b*. Check and replace microphone amplifier circuit board A4 (fig. FO-2).
		c. MIKE control R107.	*c*. Check and replace R107 (appendix D. fig. D-1).
		d. Transformer T106.	*d*. Check and replace T106.
2	Remote operating channels on remote control console will function with the microphone but not with the handset.	*a*. Handset.	*a*. Check and replace handset.
		b. Handset, microphone amplifier A4.	*b*. Check and replace handset microphone amplifier A4 (fig. FO-2).
		c. PHONE control R108.	*c*. Check and replace R108 (appendix D, fig. D-1).
		d. Diode CR101.	*d*. Check and replace CR101.
		e. Capacitor C101.	*e*. Check and replace C101.
		f. Transformer T107.	*f*. Check and replace T107.
3	One of the remote operating channels on remote control console will not function with the handset.	HANDSET XMT-MINITOR-MIKE XMT lever switch, contacts 7, 8-10, 11.	Check and replace switch (fig. FO-2). S101 for CHAN 1 (appendix D, fig. D-2). S102 for CHAN 2. S103 for CHAN 3. S104 for CHAN 4. S105 for CHAN 5

Item No.	*Symptom*	*Possible trouble*	*Corrective measures*
4	One of the remote operating channels on remote control console will not function with with microphone.	HANDSET XMT-MINITOR MIKE XMT lever switch, contacts 2, 3-5, 6.	Check and replace switch (fig. FO-2). S101 for CHAN 1 (appendix D, Fig. D-2). S102 for CHAN 2. S103 for CHAN 3. S104 for CHAN 4. S105 for CHAN 5.
5	One of the remote operating channels on remote control console will not function with either the microphone or the handset.	*a.* HANDSET XMT-MONITOR-MIKE XMT lever switch.	*a.* Check and replace switch (fig. FO-2). S101 for CHAN 1 (appendix D, fig. D-2). S102 for CHAN 2. S103 for CHAN 3. S104 for CHAN 4. S 105 for CHAN 5.
		b. Keying relay in audio control circuits in ac power and signal entrance panel.	*b.* Check and replace relay (fig. FO-3). K501 for CHAN 1 (appendix D, fig. D-3). K502 for CHAN 2. K503 for CHAN 3. K504 for CHAN 4. K505 for CHAN 5.
6	One of the remote channel call lights remains lit without a received signal being applied to the signal light control.	Signal light control circuit (fig. 4-2) board output transistors.	Replace circuit board. Refer to higher category of maintenance.
7	One of the remote channel call lights will not light.	*a.* Defective neon bulb.	*a.* Check and replace bulb.
		b. Signal light control circuit board relay.	*b.* Replace circuit board. Refer to higher category of maintenance.
		c. Signal light control circuit board transistors.	*c.* Same as *b* above.
		d. Signal light control circuit board potentiometer.	*d.* Same as *b* above.

f. Rf Switching, Troubleshooting Chart.

Item No.	*Symptom*	*Possible trouble*	*Corrective measures*
1	Operating position 1 and 2 can be operated on whip antennas but not on doublet antennas.	*a.* Relay K12 at position 1.	*a.* Replace relay (fig. 4-3).
		b. Relay K13 at position 2.	*b.* Replace relay.
		c. Switch S5 at position 1.	*c.* Replace switch.
		d. Switch S4 at position 2.	*d.* Replace switch.
2	Operating positions 1 and 2 can be operated on whip and on doublet antennas but cannot be operated into the rf amplifier.	*a.* Relay K17 at position 1.	*a.* Replace relay (fig. 4-3).
		b. Relay K18 at position 2.	*b.* Replace relay.
		c. Relay K19 in rf amplifier input selector.	*c.* Replace relay K19 (fig. FO-4).
3	Operating positions 3, 4, and 5 can be operated on doublet antennas but cannot be operated into the rf amplifier.	*a.* Relay K14 at position 3.	*a.* Replace relay K14 (fig. 4-3).
		b. Relay K15 at position 4.	*b.* Replace relay K15.
		c. Relay K16 at position 5.	*c.* Replace relay K16.
		d. Relay K19 in rf amplifier input selector.	*d.* Replace relay K19 (fig. FO-4).
4	All operating positions can be operated on doublet antennas but cannot be operated into the rf amplifier.	*a.* Relay in rf amplifier input selector.	*a.* Replace relay (fig. FO-4).
		b. Ac input power to rf amplifier input selector.	*b.* Check ac input to rf amplifier input selector (fig. FO-5).
		c. Sl in rf amplifier input selector.	*c.* Replace switch Sl (fig. FO-4).
		d. Defective rf amplifier.	*d.* Refer to TM 11-5820-554-34-1.

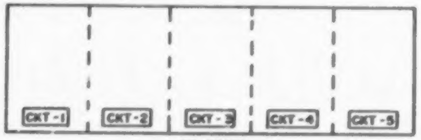
Paragraphs 4-9 through 4-16 are deleted. Next paragraph is 4-17.


+28V
SIG-1
-28V
C1
4.7UF
R1
2,200
R2
1MEG
CCW
R3
2,200
CR1
1N716
R4
220K
R5
47K
R6
15K
Q1
2N1893
R7
3,900
C3
33UF
C2
4.7UF
CR2
1N645
CR3
1N645
R8
180K
CR4
1N645
R9
10K
CR5
1N645
Q2
2N1893
TR1
R10
82K
C4
33UF
R11
1K
Q3
2N1893
R12
200
Q4
2N1893
K1
LA-1
POWER TO
CKT-2, CKT-3,
CKT-4 AND
CKT-5

CKT-1 (NOTE 3)

NOTES:

1. UNLESS OTHERWISE INDICATED, RESISTANCES ARE IN OHMS.
2. ▭ INDICATES CIRCUIT BOARD LABELS.
3. SCHEMATIC AND SYMBOLS SHOWN ARE FOR CKT-1 ONLY. OTHER CIRCUITS ARE A REPEAT OF CKT-1 AND LAID OUT ON THE PRINTED CIRCUIT BOARD AS SHOWN:


CKT-1
CKT-2
CKT-3
CKT-4
CKT-5

PC BOARD

4. TO LOCATE A COMPONENT NUMBER FOR A PARTICULAR CIRCUIT, REFER TO THE COMPONENT SYMBOL CHART BELOW:

CKT-1	CKT-2	CKT-3	CKT-4	CKT-5
Q1	Q5	Q9	Q13	Q17
Q2	Q6	Q10	Q14	Q18
Q3	Q7	Q11	Q15	Q19
Q4	Q8	Q12	Q16	Q20
TR1	TR2	TR3	TR4	TR5
K1	K2	K3	K4	K5

CKT-1	CKT-2	CKT-3	CKT-4	CKT-5
R1	R13	R25	R37	R49
R2	R14	R26	R38	R50
R3	R15	R27	R39	R51
R4	R16	R28	R40	R52
R5	R17	R29	R41	R53
R6	R18	R30	R42	R54
R7	R19	R31	R43	R55
R8	R20	R32	R44	R56
R9	R21	R33	R45	R57
R10	R22	R34	R46	R58
R11	R23	R35	R47	R59
R12	R24	R36	R48	R60
C1	C5	C9	C13	C17
C2	C6	C10	C14	C18
C3	C7	C11	C15	C19
C4	C8	C12	C16	C20
CR1	CR6	CR11	CR16	CR21
CR2	CR7	CR12	CR17	CR22
CR3	CR8	CR13	CR18	CR23
CR4	CR9	CR14	CR19	CR24
CR5	CR10	CR15	CR20	CR25

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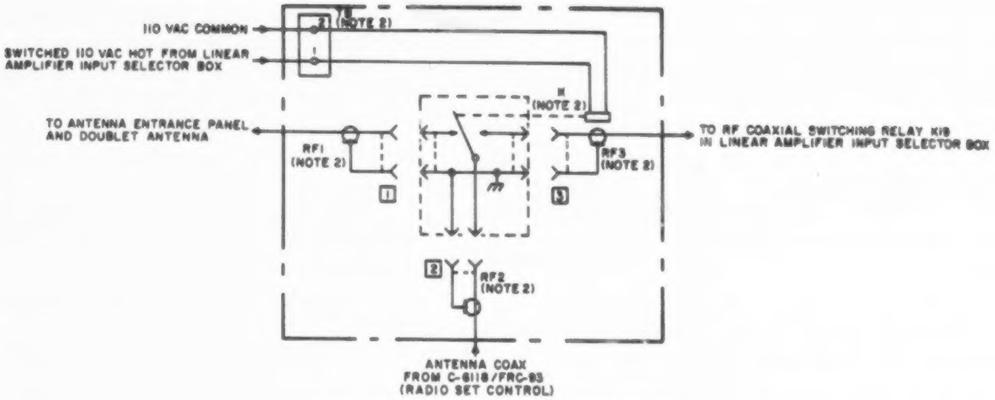
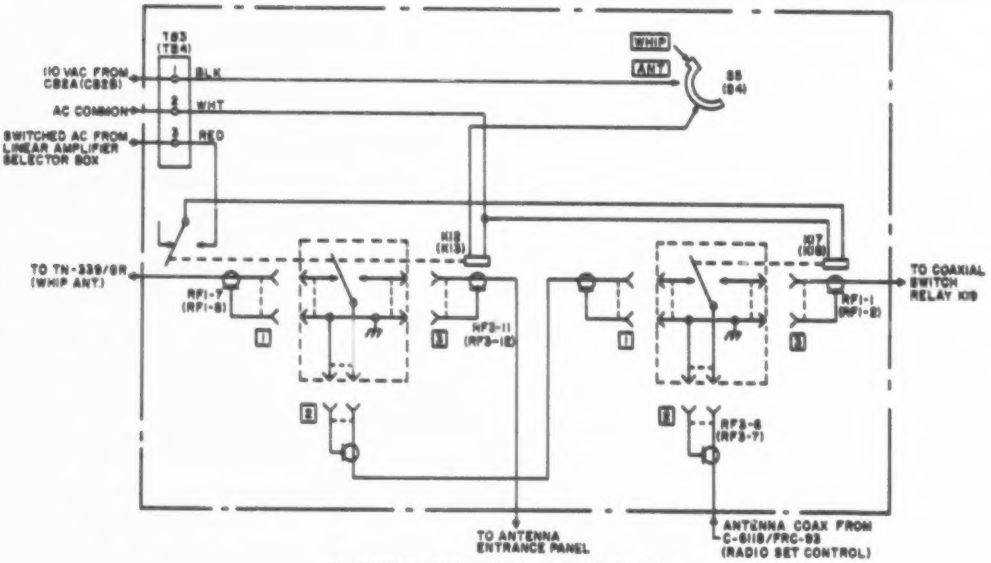
Figure 4-8. Signal light control, schematic diagram.


TB
(NOTE 2)
2
1
110 VAC COMMON
SWITCHED 110 VAC HOT FROM LINEAR AMPLIFIER INPUT SELECTOR BOX
K
(NOTE 2)
TO ANTENNA ENTRANCE PANEL AND DOUBLET ANTENNA
RF1
(NOTE 2)
1
3
RF3
(NOTE 2)
TO RF COAXIAL SWITCHING RELAY K19 IN LINEAR AMPLIFIER INPUT SELECTOR BOX
2
RF2
(NOTE 2)
ANTENNA COAX
FROM C-6118/FRC-93
(RADIO SET CONTROL)

A. OPERATING POSITIONS 3,4 AND 5. (NOTE 2)


TB3
(TB4)
110 VAC FROM CB2A(CB2B)
AC COMMON
SWITCHED AC FROM LINEAR AMPLIFIER SELECTOR BOX
1
2
3
BLK
WHT
RED
WHIP
ANT
S5
(S4)
K12
(K13)
K17
(K18)
TO TN-339/GR
(WHIP ANT.)
RF1-7
(RF1-8)
1
3
RF3-11
(RF3-12)
1
3
RF1-1
(RF1-2)
TO COAXIAL SWITCH RELAY K19
2
2
RF3-6
(RF3-7)
TO ANTENNA ENTRANCE PANEL
ANTENNA COAX FROM C-6118/FRC-93
(RADIO SET CONTROL)

B. OPERATING POSITIONS 1 AND 2. (NOTE 1)

NOTES:

1. SYMBOL NUMBERS IN ( ) ARE FOR OPERATING POSITION 2.
2. SYMBOL AND COMPONENT FOR EACH POSITION ARE AS FOLLOWS:

COMPONENTS	POSITIONS		
	3	4	5
RELAY	K14	K15	K16
TB	5	6	7
RF1	RF3-13	RF3-14	RF3-15
RF2	RF3-8	RF3-9	RF3-10
RF3	RF1-3	RF1-4	RF1-5

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Figure 4-3. Rf switching relays, schematic diagram.

4-17. Removal and Replacement of the Signal Light Control Printed Circuit Board

a. General. During troubleshooting of the remote control console and its associated circuitry, if the trouble is isolated to the signal light control printed circuit board, located in the ac power and signal entrance box (Appendix D, fig. D-3), remove and replace the signal light control printed circuit board in accordance with the procedures given in *b* and *c* below.

b. Removal. Remove the signal light control printed circuit board (fig. D-4) as follows:

(1) Remove all power from the shelter.

(2) Remove the cover from the ac power and signal entrance box in the shelter.

CAUTION

Before attempting any work in the ac power and signal entrance box, discharge capacitor C501 (fig. D-3) of any hazardous voltage by using a suitable insulated grounding tool.

(3) Remove and retain the six screws that fasten the signal light control printed circuit board to the mounting brackets.

(4) Tag and disconnect the wires to the printed circuit board by loosening the screws that secure the leads to the input/output terminals.

(5) Remove the signal light control printed circuit board from the ac power and signal entrance box.

c. Replacement. Replace the signal light control printed circuit board as follows:

(1) Place the circuit board back into the ac power and signal entrance box.

(2) Reconnect the wires to the printed circuit board in accordance with the terminal designations on the tags (*b* (4) above).

(3) With the six screws, fasten the signal light control printed circuit board to the mounting brackets.

(4) Replace the cover on the ac power and signal entrance box in the shelter.

(5) Turn the shelter power back on (para 3-8).

4-18. Electrical Test for AN/ TRC-133A Shelter and Remote Control

The electrical tests given below will test out the dc power distribution panel, the rf switches, the amplifier input selector switch, the continuity of the remote and the power cables, and the operation of the remote control console.

a. Test conditions.

(1) All circuit breakers in AC POWER DISTRIBUTION PANEL (fig. 3-1) should be at OFF.

(2) All circuit breakers in the dc power distribution panel (fig. 3-2) should be in the off position (pulled out).

(3) Connect a 24-volt battery to the dc cable. Voltmeter on dc power distribution panel (fig. 3-2) will indicate source voltage.

b. Electrical Check of DC Power Distribution Panel.

Step No.	Control Settings		Test procedure	Performance standard
	Test equipment	Equipment under test		
1	N/A	DC Power Distribution Panel. Set controls in accordance with test procedure.	*a.* Depress MAIN circuit breaker (fig. 3-2).	*a.* MAIN, red indicator lamp will light and five other indicator lamps will remain out.
			b. Depress the five remaining indicator lamps in turn.	*b.* The lamps will light.
2	N/A	Same as above.	Depress POS-1 circuit breaker.	POS-1 red indicator lamp will light.
3	Multimeter, TS-352B or equivalent. FUNCTION: DIRECT RANGE: 50 VDC	Same as above.	Set multimeter on 50-volt DC range and connect it to DC power supply (fig. 1-6), position 1 cable, cable ring-type terminals.	24 VDC with polarity indicated on wire labels.
4	Multimeter, TS-352B or equivalent.	Same as above.	Pull out POS 1 (fig. 3-2) circuit breaker.	POS-1 indicator lamp will extinguish and meter will indicate 0 volts.
5	N/A	Same as above.	Depress POS-2 circuit breaker.	POS-2 red indicator lamp will light.
6	Multimeter, TS-352B or equivalent. FUNCTION: DIRECT RANGE: 50 VDC	Same as above.	Connect Multimeter to DC power supply (fig. 1-6) POSITION 2 cable ring-type terminals.	24 volts. DC with polarity as indicated on wire labels.
	Multimeter, TS-352B or equivalent.	Same as above.	Pull out POS 2 (fig. 3-2) circuit breaker.	POS-2 indicator lamp will extinguish. Multimeter will indicate 0 volts.

Step No.	Control Settings		Test procedure	Performance standard
	Test equipment	Equipment under test		
8	N/A	Same as above.	Depress LIGHT circuit breaker.	LIGHT red indicator lamp will light and dc lamp (fig. 1-6) in ceiling of shelter will light if LIGHT switch is at ON.
9	N/A	Same as above.	Pull out LIGHT circuit breaker.	LIGHT indicator lamp will extinguish and DC lamp will extinguish.
10	N/A	Same as above.	Depress FAN circuit breaker.	FAN red indicator lamp will light. DC fan (fig. 1-11) mounted in ceiling will operate if its switch is at ON.
11	N/A	Same as above.	Pull out FAN circuit breaker.	FAN indicator lamp will extinguish and DC fan will turn off.
12	N/A	Same as above.	Depress REMOTE circuit breaker.	REMOTE red power indicator lamp will light.
13	Multimeter, TS-352B or equivalent. FUNCTION: DIRECT RANGE: 50 VDC	Same as above.	Connect multimeter to terminals 23 and 24 of TB52 (Appendix D, fig. D-3).	24 volts DC
14	N/A	Same as above.	On the DC power distribution panel (fig. 3-2), pull out the REMOTE circuit breaker.	REMOTE indicator lamp will extinguish and voltmeter will indicate 0.
15	N/A	Same as above.	Pull out MAIN circuit breaker.	MAIN indicator lamp will extinguish.
16	N/A	Same as above.	Disconnect the battery connected in *a* above.	N/A

c. Electrical Check of Rf Amplifier Input Selector Switch.

Step No	Control Settings		Test procedure	Performance standard
	Test equipment	Equipment under test		
1	Multimeter, TS-352B or equivalent. FUNCTION: OHMS RANGE R X 1	Rf amplifier input selector switch. Set controls in accordance with test procedure.	Set multimeter on the R X 1 scale and connect it between the center contact of ANTENNA 1 connector and the center contact of Connector UG-594 C/U on cable RF3-6 (fig. FO-7).	Infinite resistance
2	N/A	Same as above.	Set WHIP-ANT rf switch (B, fig. 3-3) at position 1 to ANT.	None.
3	Multimeter, TS-352B or equivalent.	Same as above.	Set AC POWER DISTRIBUTION PANEL circuit breaker, POS 1 (fig. 3-1), to ON.	*a.* Relay at position 1 will operate audibly. *b.* Multimeter will indicate 0 ohms.
4	N/A	Same as above.	Set the AC POWER DISTRIBUTION PANEL circuit breaker for AMPL to ON.	None.
5	Multimeter, TS-352B or equivalent. FUNCTION: OHMS RANGE: R X 1	Same as above.	Set the AMPLIFIER INPUT SELECTOR switch (fig 3-5) to position 1.	*a.* Indicator lamp number 1 will light and relay will operate audibly. *b.* Multimeter will indicate infinite resistance.

Step No	Control Settings		Test procedure	Performance standard
	Test equipment	Equipment under test		
6	Multimeter, TS-352B or equivalent. FUNCTION: OHMS RANGE: R X 1	Same as above.	Place the multimeter between center contact of Connector UG-594 C/U on rf cable RF3-6 (fig. FO-7) and the lug connected to the center conductor of cable RF1-7.	Infinite resistance.
7	Multimeter, TS-352B or equivalent. FUNCTION: OHMS RANGE: R X 1	Same as above.	Set the rf switch (fig. 3-3) at position 1 to WHIP.	*a.* The relay will operate audibly. *b.* Voltmeter will indicate 0 ohm.
8	N/A	Same as above.	On the AC POWER DISTRIBUTION PANEL (fig. 3-1), set the ac circuit breaker for POS 1 to OFF.	None.
9	Multimeter, TS-352B or equivalent. FUNCTION: OHMS RANGE: R X 1	Same as above.	Connect the multimeter between the center contact of ANTENNA 2 connector and the center contact of Connector UG-594 C/U on cable RF3-7.	Infinite resistance.
10	N/A	Same as above.	Set the rf switch (B, fig. 3-3) at position number 2 to ANT.	None.
11	Multimeter, TS-352B or equivalent. FUNCTION: OHMS RANGE: R X 1	Same as above.	SET AC POWER DISTRIBUTION PANEL, POS 2 (fig. 3-1) circuit breaker to ON.	Relay at position number 2 will operate audibly and multimeter will indicate 0 ohm.
12	Multimeter, TS-352B or equivalent. FUNCTION: OHMS RANGE: R X 1	Same as above.	Operate AMPLIFIER INPUT SELECTOR switch (fig. 3-5) to position 2.	Indicator lamp 1 will extinguish and indicator lamp 2 will light. Multimeter will indicate infinite resistance and relay will operate audibly.
13	Multimeter, TS-352B or equivalent. FUNCTION: OHMS RANGE: R X 1	Same as above.	Connect the multimeter between the center contact of Connector UG-594/U on cable RF3-7 (fig. FO-7) and the lug connected to the center conductor of cable RF1-8.	Infinite resistance.
14	Multimeter, TS-352B or equivalent. FUNCTION: OHMS RANGE: R X 1	Same as above.	Set the rf switch (B, fig. 3-3) at position 2 to WHIP.	The relay will operate audibly and the multimeter will indicate 0 ohm.
15	N/A	Same as above.	On the AC POWER DISTRIBUTION PANEL (fig. 3-1) set the ac circuit breaker at POS 2, to OFF.	None.
16	Multimeter, TS-352B or equivalent. FUNCTION: OHMS RANGE: R X 1	Same as above.	Connect the multimeter between the center contact of ANTENNA 3 connector and the center contact of UG-594C/U connector on cable RF3-8 (fig. FO-7).	0 ohm.
17	Multimeter, TS-352B or equivalent. FUNCTION: OHMS RANGE: R X 1	Same as above.	Set the AMPLIFIER INPUT SELECTOR switch (fig. 3-5) to position number 3.	*a.* The relay will operate audibly. *b.* Lamp number 2 on the AMPLIFIER INPUT SELECTOR switch will extinguish and indicator lamp number 3 will light. *c.* Multimeter will indicate infinite resistance. 0 ohm.

Step No.	Control Settings		Test procedure	Performance standard
	Test equipment	Equipment under test		
18	Multimeter, TS-352B or equivalent. FUNCTION: OHMS RANGE: R X 1	Same as above.	Connect the multimeter between the center contact of UG-594C/U connector on cable RF3-9 (fig. FO-7).	0 ohm.
19	Multimeter, TS-352B or equivalent. FUNCTION: OHMS RANGE: R X 1	Same as above.	Set AMPLIFIER INPUT SELECTOR switch (fig. 3-5)to position 4.	*a.* Relay will operate audibly. *b.* Indicator lamp 3 will extinguish and indicator lamp 4 will light. *c.* Multimeter will indicate infinite resistance.
20	Multimeter, TS-352B or equivalent. FUNCTION: OHMS RANGE: R X 1	Same as above.	Connect the multimeter between the center contact of ANTENNA 5 connector and the center contact of UG-594C/U connector on cable RF3-10 (fig. FO-7).	0 ohm.
21	Multimeter, TS-352B or equivalent. FUNCTION: OHMS RANGE: R X 1	Same as above.	Set the AMPLIFIER INPUT SELECTOR switch (fig. 3-5) to position number 5.	*a.* Relay will operate audibly. *b.* Indicator lamp number 4 will extinguish and number 5 will light. *c.* Multimeter will indicate infinite resistance.
22	N/A	Same as above.	Set AMPLIFIER INPUT SELECTOR switch (fig. 3-5) to OFF.	All the indicator lamps on the AMPLIFIER/INPUT SELECTOR switch will be extinguished.

d. Electrical Check of Linear Amplifier Positions 1 through 5.

Step No.	Control Settings		Test procedure	Performance standard
	Test equipment	Equipment under test		
1	Multimeter, TS-352B or equivalent. FUNCTION: OHMS RANGE: R X 1	Linear Amplifier Positions 1 through 5. Set controls in accordance with test procedure.	Connect the multimeter between the center contact of the UG-594C/U connector on cable RF3-6 (fig. FO-7) and the center contact of connector PL-259A on cable RF1-6.	None
2	N/A	Same as above.	Set the rf switch (B, fig. 3-3) at position 1 to ANT.	None.
3	N/A	Same as above.	On the AC POWER DISTRIBUTION PANEL (fig. 3-1), set the POS 1 and AMPL circuit breakers to ON.	None.
4	Multimeter, TS-352B or equivalent. FUNCTION: OHMS RANGE: R X 1	Same as above.	Set the AMPLIFIER INPUT SELECTOR switch (fig. 3-5) to position 1.	0 ohm.
5	N/A	Same as above.	Set the rf switch (B, fig. 3-3) to WHIP.	None.
6	Multimeter, TS-352B or equivalent. FUNCTION: OHMS RANGE: R X 1	Same as above.	Connect the ohmmeter between the center contact of the UG-594C/U connector on cable RF3-7 (fig. FO-7) and the center contact of Connector PL-259A on cable RF1-6.	None.
7	N/A	Same as above.	Set the rf switch (B, fig. 3-3) at position 2 to ANT.	
8	N/A	Same as above.	On the AC POWER DISTRIBUTION PANEL (fig. 3-1), set POS 2 circuit breaker to ON.	None.

Step No.	Control Settings		Test procedure	Performance standard
	Test equipment	Equipment under test		
9	Multimeter, TS-352B or equivalent. FUNCTION: OHMS RANGE: R X 1	Same as above.	Set the AMPLIFIER INPUT SELECTOR switch (fig. 3-5) to position 2.	0 ohm.
10	N/A	Same as above.	Set the rf switch (B, fig. 3-3) at position 2 to WHIP.	
11	Multimeter, TS-352B or equivalent. FUNCTION: OHMS RANGE: R X 1	Same as above.	Connect the multimeter between the center contact of connector KN-59 on cable RF3-8 (fig. FO-7) and the center contact of connector PL-259A on cable RF1-6.	None.
12	Multimeter, TS-352B or equivalent. FUNCTION: OHMS RANGE: R X 1	Same as above.	Set AMPLIFIER INPUT SELECTOR switch (fig. 3-5) to position 3.	0 ohm.
13	Multimeter, TS-352B or equivalent.	Same as above.	Connect multimeter between the center contact of Connector UG-594C/U on cable RF3-9 (fig. FO-7) and the center contact of the connector PL-259A on cable RF1-6.	None.
14	Multimeter, TS-352B or equivalent. FUNCTION: OHMS RANGE: R X 1	Same as above.	Set the AMPLIFIER INPUT SLECTOR switch (fig. 3-5) to position 4.	0 ohm.
15	Multimeter, TS-352B or equivalent. FUNCTION: OHMS RANGE: R X 1	Same as above.	Connect multimeter between the center contact of Connector UG-594C/U on cable RF3-10 (fig. FO-7) and the center contact of connector PL-259A on cable RF1-6.	None.
16	Multimeter, TS-352B or equivalent. FUNCTION: OHMS RANGE: R X 1	Same as above.	Set the AMPLIFIER INPUT SELECTOR switch to position 5.	0 ohm.
17	N/A	Same as above.	Set the AMPLIFIER INPUT SELECTOR switch to OFF.	None.

e. Voltage Check of Power Supply RB-23

Step No.	Control Settings		Test procedure	Performance standard
	Test equipment	Equipment under test		
1	N/A	Power Supply RB-23	Set up the remote control console (para 2-9).	None.
2	Multimeter, TS-352B or equivalent. FUNCTION: DIRECT RANGE: 50 VDC	Set controls in accordance with test procedure.	Measure the voltage output of regulated power supply RB-23 (fig. 1-6) between terminals 3 and 6.	24 VDC ± .5V.
3	Multimeter, TS-352 or equivalent. FUNCTION: DIRECT RANGE: R X 1	Same as above.	If the voltage output of the power supply does not read as indicated in (2) above, adjust R10 (fig. 4-5).	Same as above.

Step No.	Control Settings		Test procedure	Performance standard
	Test equipment	Equipment under test		
4	Multimeter, TS-352 or equivalent. FUNCTION: DIRECT RANGE: 50 VDC	Same as above.	One man at the remote control console depresses all five call lights simultaneously, and a second man in the shelter measures the output voltage (2) above.	24 VDC ± .5 V.

f. Continuity Check for Dc Power Supply Cable Positions.

Step No.	Control Settings		Test procedure	Performance standard
	Test equipment	Equipment under test		
1	Multimeter, TS-352B or equivalent. FUNCTION: OHMS R X 1	DC power supply cable	At position 1, set the 110VAC-28VDC switch (A, fig. 3-3) to 28VDC. Check continuity between wire terminations at TB1 (fig. 4-4) at DC POWER SUPPLY POSITION 1 and OCTAL-type receptacle at position 1 (pin receptacle numbers from 1 through 11 counterclockwise from right of keyway as follows: *a.* From wire marked TB-2 to OCTAL terminal 3 and OCTAL terminal 7. *b.* From wire marked TB-3 to OCTAL terminal 10. *c.* From wire marked TB-4 to OCTAL terminal 1. *d.* From wire marked TB-5 to OCTAL terminal 2. *e.* From wire marked TB-6 to OCTAL terminal 4. *f.* From wire marked TB-7 to OCTAL terminal 5. *g.* From wire marked TB-8 to OCTAL terminal 6.	Continuity.
2	Multimeter, TS-352B or equivalent. FUNCTION: OHMS R X 1	Same as above.	Check continuity between the DC POWER SUPPLY POSITION 2 and OCTAL-type receptacle at position 2 by setting the 110VAC-28VDC switch (A, fig. 3-3) at position 2 to 28VDC and following the procedure outlined in (*a*) through (*g*) above.	Continuity.

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g. Continuity Check for Ac Power Supply Cable Positions 1 through 5.

Step No.	Control Settings		Test procedure	Performance standard
	Test equipment	Equipment under test		
1	Multimeter, TS-352B or equivalent. FUNCTION: OHMS R X 1	Ac Power Supply Cable.	At position 1, set the 110VAC-28VDC switch (A, fig. 3-3) to 110VAC. Check for continuity from the pins of the OCTAL socket of cable ACK-1 at ac power supply at position 1 to the pins in the OCTAL connector at position 1. Continuity will be observed at pins arranged clockwise from the keyway of the OCTAL socket of cable ACX-1 and counterclockwise from the keyway of the OCTAL connector at position 1 from terminals 1 through 11, to terminals 1 through 11, consecutively.	Continuity.
2	Multimeter, TS-352B or equivalent. FUNCTION: OHMS R X 1	Same as above.	At position 2, set the 110VAC-28VDC switch to 110VAC. Check the continuity of the ac power supply cable at position 2 in the same manner as in (1) above.	Continuity.
3	Multimeter, TS-352B or equivalent. FUNCTION: OHMS R X 1	Same as above.	Check the continuity of the ac power supply cable to positions 3 through 5 in the same manner as in (1) above.	Continuity.

h. Remote Control Console, Functional Test.

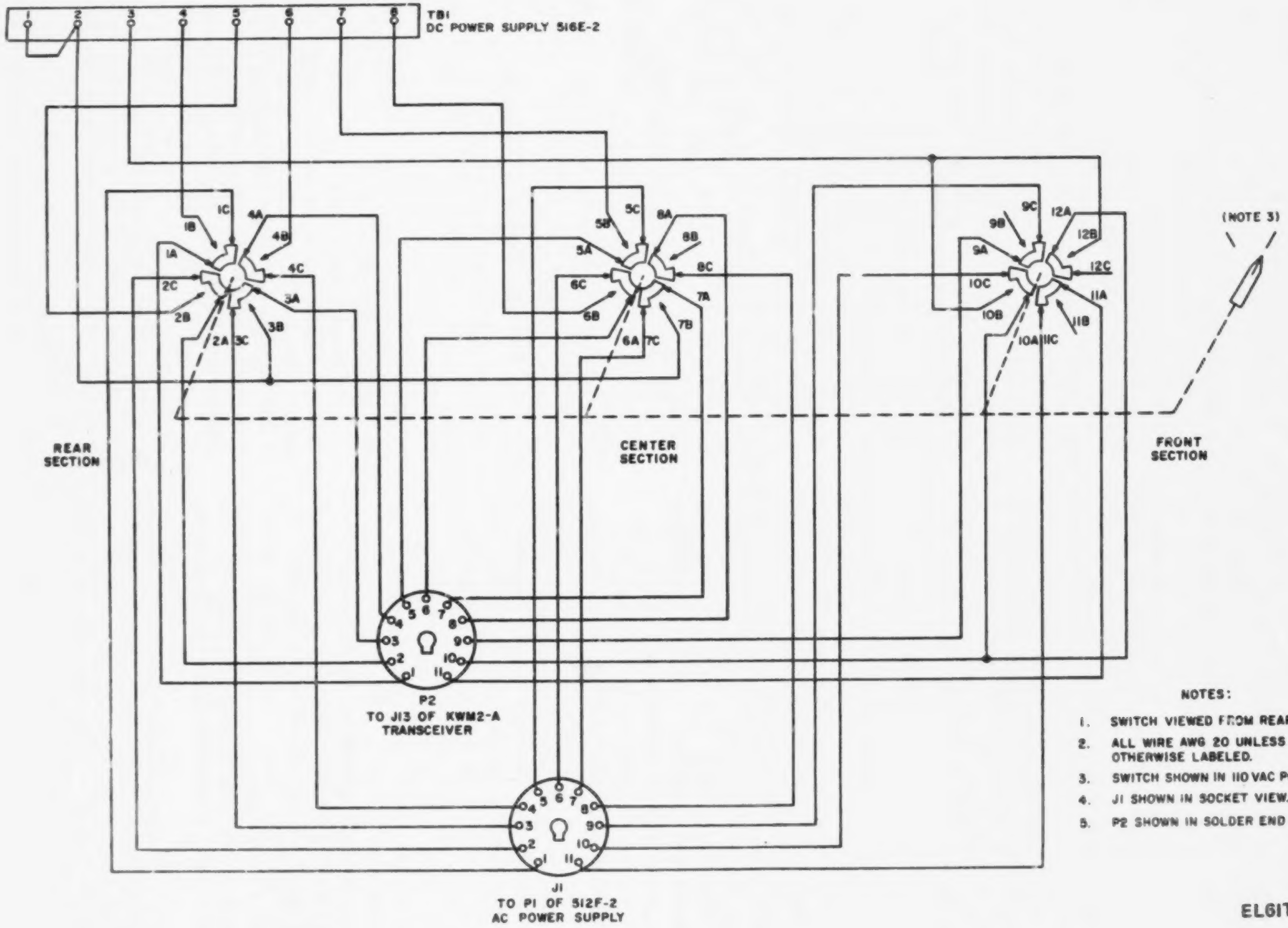
Step No.	Control Settings		Test procedure	Performance standard
	Test equipment	Equipment under test		
1	N/A	Remote Control Console in accordance with test procedure.	Connect remote control console to the shelter, using the remote cable assembly (para 2-9).	None.
2	N/A	Same as above.	On the AC POWER DISTRIBUTION PANEL (fig. 3-1), set the circuit breaker DC SUP to ON.	None.
3	N/A	Same as above.	On the dc power distribution panel (fig. 3-2), push in REMOTE circuit breaker.	The red indicator light over REMOTE on the dc power distribution panel will light.
4	N/A	Same as above.	Press each green indicator lens of the remote control console (fig. 3-7) in sequence.	Each indicator light should light when depressed and extinguish when released.
5	Audio Signal Generator, 0-1025/U or equivalent.	Same as above.	Connect the output of a signal generator to PHONO plug marked 500 OHM at position 1.	None.
6	Audio Signal Generator 0-1025/U or equivalent. AMPLITUDE: APPROX 35	Same as above.		The CHAN 1 green indicator light will light on the remote control console.

NOTE

The signal light control circuit board may need adjustment in order to light the indicators on the remote control console (para 3-12).

Step No.	Control Settings		Test procedure	Performance standard
	Test equipment	Equipment under test		
7	Audio Signal Generator, 0-1025/U or equivalent. AMPLITUDE: Reduce to 10.	Same as above.		The CHAN 1 green indicator lamp will extinguish after a delay of approximately 4 seconds.
8	Audio Signal Generator	Same as above.	Sequentially connect the OUTPUT of the signal generator to the PHONO plugs at positions 2, 3, 4, and 5 marked 500 OHM.	None.
9	Audio Signal Generator	Same as above.	For each of the positions 2, 3; 4 and 5; follow the steps outlined in 6 and 7 above.	Same as in steps 6 and 7.
10	Audio Signal Generator	Same as above.	Disconnect the signal generator.	None.
11	N/A	Same as above.	Plug the microphone into the MICROPHONE jack on the remote control console (fig. 3-7).	None.
12	Multimeter, TS-352B or equivalent. FUNCTION: OHMS R X 1	Same as above.	Connect multimeter between GROUND and PHONO plug marked PHONE-PATCH at position 1.	None.
13	Multimeter	Same as above.	On remote control console, set the HANDSET XMT-MONITOR-MIKE XMT key for CHAN 1 to MIKE XMT, and press the talk switch on the microphone.	15,000 ohms.
14	N/A	Same as above.	Restore the HANDSET-XMT-MONITOR-MIKE XMT key for CHAN 1 to MONITOR.	None.
15	Multimeter	Same as above.	Repeat step 12 above for positions 2, 3, 4, and 5.	None.
16	Multimeter	Same as above.	Repeat steps 13 and 14 above for CHAN 2, 3, 4 and 5.	Approx. 15,000 ohms.
17	Multimeter	Same as above.	Connect multimeter between ground and PHONO plug marked PTT at position 1.	None.
18	Multimeter FUNCTION: OHMS R X 1	Same as above.	On the remote control console, set the HANDSET XMT-MONITOR-MIKE XMT key for CHAN 1 to MIKE XMT, and press the talk switch on the mictrophone.	Approx 0 ohms.
19	N/A	Same as above.	Restore the HANDSET XMT-MONITOR-MIKE XMT key for CHAN 1 to MONITOR.	None.
20	Multimeter	Same as above.	Repeat step 17 above for positions 2, 3, 4, and 5.	None.
21	Multimeter FUNCTION: OHMS R X 1	Same as above.	Repeat steps 18 and 19 above for CHAN 2, 3, 4 and 5.	Approx 0 ohms.
22	N/A	Same as above.	On the remote control console, connect the telephone handset to the HANDSET jack.	None.

Step No.	Control Settings		Test procedure	Performance standard
	Test equipment	Equipment under test		
23	Multimeter.	Same as above	Connect the multimeter between ground and PHONO plug marked PHONEPATCH at position 1.	None.
24	Multimeter FUNCTION: OHMS R X 1	Same as above.	Set the HANDSET XMT-MONITOR-MIKE XMT key for CHAN 1 to HANDSET XMT. Press the talk switch on the handset.	Approx. 15,000 ohms.
25	N/A	Same as above.	Restore the HANDSET XMT-MONITOR-MIKE XMT key to MONITOR.	None.
26	N/A	Same as above.	Repeat step 23 above for positions 2, 3, 4, and 5.	None.
27	Multimeter FUNCTION: OHMS R X 1	Same as above.	Repeat steps 24 and 25 for CHAN 2, 3. 4 and 5.	
28	Multimeter	Same as above.	Connect multimeter between ground and PHONO plug marked PTT at position 1.	None.
29	Multimeter FUNCTION: OHMS R X 1	Same as above.	On the remote control console, set the HANDSET XMT-MONITOR-MIKE XMT key for CHAN 1 to HANDSET XMT. Press the talk switch on the handset.	Approx 0 ohms.
30	N/A	Same as above.	Restore the HANDSET XMT-MONITOR-MIKE XMT key for CHAN 1 to HANDSET XMT. Press the talk switch on the handset.	None.
31	Multimeter	Same as above.	Repeat steps 28 above for positions 2, 3, 4, and 5.	None.
32	Multimeter FUNCTION: OHMS R X 1	Same as above.	Repeat steps 29 and 30 above for CHAN 2, 3, 4 and 5.	Approx 0 ohms.
33	N/A	Same as above.	Disconnect the handset.	None.
34	N/A	Same as above.	Connect Telephone Set TA-312/PT to ORDER WIRE terminals on the remote control console and a telephone set to the order-wire terminals within the shelter. Check the order-wire line for ringing and talking.	Ringing and talking on the line.


TB1
DC POWER SUPPLY 516E-2
1
2
3
4
5
6
7
8
1A
1B
1C
2A
2B
2C
3A
3B
3C
4A
4B
4C
5A
5B
5C
6A
6B
6C
7A
7B
7C
8A
8B
8C
9A
9B
9C
10A
10B
10C
11A
11B
11C
12A
12B
12C
(NOTE 3)
REAR SECTION
CENTER SECTION
FRONT SECTION
P2
TO J13 OF KWM2-A TRANSCEIVER
J1
TO P1 OF 512F-2 AC POWER SUPPLY

NOTES:

1. SWITCH VIEWED FROM REAR.
2. ALL WIRE AWG 20 UNLESS OTHERWISE LABELED.
3. SWITCH SHOWN IN 110 VAC POSITION.
4. J1 SHOWN IN SOCKET VIEW.
5. P2 SHOWN IN SOLDER END VIEW.

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Figure 4-4. 110VAC-28VDC selector switch, schematic diagram.

Figure 4-5. 24-volt dc power supply (RB-23-6.0) schematic diagram. (Located in back of manual)

Section IV. GENERAL SUPPORT MAINTENANCE

4-19. Tools and Test Equipment Required For General Support

The following tools and test equipment are required for General Support Maintenance.

a. Spectrum Analyzer TS-723D/U, or equivalent.

b. Multimeter TS-352B/U, or equivalent.

c. Multimeter ME-26D/U, or equivalent.

d. Oscilloscope AN/USM-140A/U, or equivalent.

e. Audio Signal Generator 0-1025/U, or equivalent.

f. Tool Kit, Electronic Equipment TK-105/G, or equivalent.

4-20. Scope of General Support Maintenance

This section covers the functional description of the signal light control printed circuit board, the repair of the heater, and the shelter. General support maintenance includes all organizational and direct support maintenance procedures. Refer to the applicable technical manuals (App A) for general support maintenance procedures on the standard items of equipment and for information concerning functioning and replacement and repair techniques.

4-21. Signal Light Control Circuit Function.

The signal light control circuit board (fig D-3) is made up of five identical radio signal light control circuits. Each of these five circuits activates an associated call light indicator lamp on the remote control console when an audio signal is received on its associated radio set. Because these five signal light control circuits are identical, the functioning of only one is covered in *a* through *e* below:

a. The signal light control circuit provides the dc voltage to light the associated call light through the closed contacts of relay K1 (fig. 4-2).

b. Transistor Q1 amplifies the audio input from the receiver section of the transceiver. Transistor Q2 is conducting before an audio signal is applied to the input at SIG-1 because of the forward bias applied from the +28-volt supply. When the audio signal is applied, it is amplified through transistor Q1. The resultant output of transistor Q1 causes Q2 to be cut off.

c. When Q2 cuts off, its collector voltage increases toward the +28-volt supply and thus applied a forward bias to the base of Q3, causing it to conduct.

d. When transistor Q3 conducts, it applies forward bias to Q4, thus causing Q4 to conduct. This energizes relay K1, which applies +28 volts dc to the associated receive lamp on the remote control console.

e. The time constant of the discharge circuit of capacitor C4 causes Q3 and Q4 to conduct from 4 to 12 seconds after the received call is ended. Potentiometer R2 controls the amplitude of the audio signal fed to Q1 which, in turn, determines the amount of voltage to which capacitors C2 and C4 will charge when an input signal is received. In turn, this determines the length of time that relay K1 will remain energized after the call is completed.

4-22. Heater Repairs

(fig C-5)

a. *Replacement of HEAT-OFF-FAN Switch*.

(1) Remove the mounting screws that hold the backplate to the cabinet and remove the backplate.

(2) Remove the mounting nut from the HEAT-OFF-FAN switch on top of the heater cabinet.

(3) Loosen the turnlock fasteners that secure the cabinet to the heater base and remove the cabinet.

(4) Tag and remove the switch leads.

(5) Connect the switch leads to the replacement switch.

(6) Position the cabinet on the top of the heater base; check to make sure the switch fits into the hole on the top of the cabinet.

(7) Secure the switch to the top of the cabinet with the switch mounting nut.

(8) Secure the backplate to the cabinet with the mounting screws.

b. *Replacement of Temperature Control Unit*.

(1) Loosen the screws that connect the wires to the temperature control unit.

(2) Remove the screws that secure the temperature control unit to the cabinet and remove the unit.

(3) Insert the TEMPERATURE CONTROL on the replacement unit through the slot in the cabinet. Replace and tighten the screws.

(4) Connect the wires to the temperature control unit.

c. *Replacement of Heating Element*.

(1) Remove the mounting screws that hold the backplate to the cabinet and remove the backplate of the heater.

(2) Remove the mounting nut from the HEAT-OFF-FAN switch on the top of the heater cabinet.

(3) Loosen the turnlock fasteners that hold the cabinet to the heater base and remove the cabinet.

(4) Remove the finned heating element mounting screws.

(5) Grasp the finned heating element and pull downward to remove.

(6) Install the replacement finned heating element; check to make sure that the two-pronged electrical connector is properly seated in its mating connector.

(7) Secure the finned heating element with the mounting screws.

(8) Position the cabinet on the top of the heater base; check to make sure the HEAT-OFF-FAN switch fits into the hole on the top of the cabinet.

(9) Secure the HEAT-OFF-FAN switch to the top of the cabinet with the switch mounting nut.

(10) Secure the backplate to the cabinet with the mounting screws.

(11) Tighten the turnlock fasteners that secure the cabinet to the heater base.

d. Replacement of Motor and Impeller.

(1) Remove the screws that secure the motor bracket to the cabinet and lift out the motor bracket as one unit.

(2) Tag and replace the motor leads from the HEAT-OFF-FAN switch and from the taped splice in the heating element cable.

(3) Remove the screws that secure the motor to the bracket.

(4) Unscrew the metal fastener that secures the impeller to the motor shaft and remove the impeller.

(5) Place the new impeller on the motor shaft and secure it with the metal fastener.

(6) Place the motor on the bracket and secure it with the screws.

(7) Connect the motor leads to the HEAT-OFF-FAN switch and to the splice in the heating element cable.

(8) Place the motor in the cabinet; replace and tighten the screws that secure the motor bracket to the cabinet.

4-23. Repair of Shelter

The exterior of the shelter is vulnerable to punctures or gouging when the shelter is being loaded and transported. Refer to TB 746-10 for instructions on maintenance and repair of the shelter.

4-24. Testing Signal Light Control Printed Circuit Board

Figures 4-1, FO-6, and appendix D, fig. D-4 are schematic, wiring, and component location diagrams provided to assist the maintenance technician when troubleshooting and repairing the signal light control printed circuit board. (Refer to TB SIG 222 for troubleshooting and repair techniques of printed circuit boards.) Use the following procedures to check the signal light control printed circuit board for proper operation:

a. Connect a 28-volt dc test lamp (type 327 or equivalent) between the terminals labeled LA-1 and −28VDC (ground).

b. Apply +28 volts dc to the signal light control printed circuit board. Observe proper polarity (+ to +28VDC terminal; − to −28VDC terminal).

c. Apply a 1000-MHz signal to terminal SIG-1. Vary the amplitude of the input signal between 0.6 volt and 1.2 volts rms. The test lamp should light. (A slight adjustment of input potentiometer R2 may be necessary to cause the lamp to light.)

d. With the test lamp lighted, remove the 1000-MHz input signal. The test lamp should remain lighted for approximately 8 seconds ± 2 after removal of the input signal.

e. The procedures outlined in *a* through *d* above pertain to CKT-1 of the signal light control printed circuit board. Perform similar procedures when checking CKT-2 through CKT-5 for proper operation. Refer to the chart on figure 4-2 for the proper reference designations of the components in CKT-2 through CKT-5.

4-25. Additional Troubleshooting Data

a. Appendix E contains manufacturer's Maintenance Instruction Sheets on the following non-standard components of the AN/TRC-133A:

(1) Directional Wattmeter Model 302C-2.
(2) Dummy Load Model DL-1.
(3) Dummy Load DA-75/U.
(4) Terminal Protective Device 11053186.
(5) Electric Space Heater, Valad Model: P15D.

b. Appendix E also contains a reprint of NAVSHIPS 0969-209-3020 Technical Manual for Electrical Dummy Load DA-4.12A/U

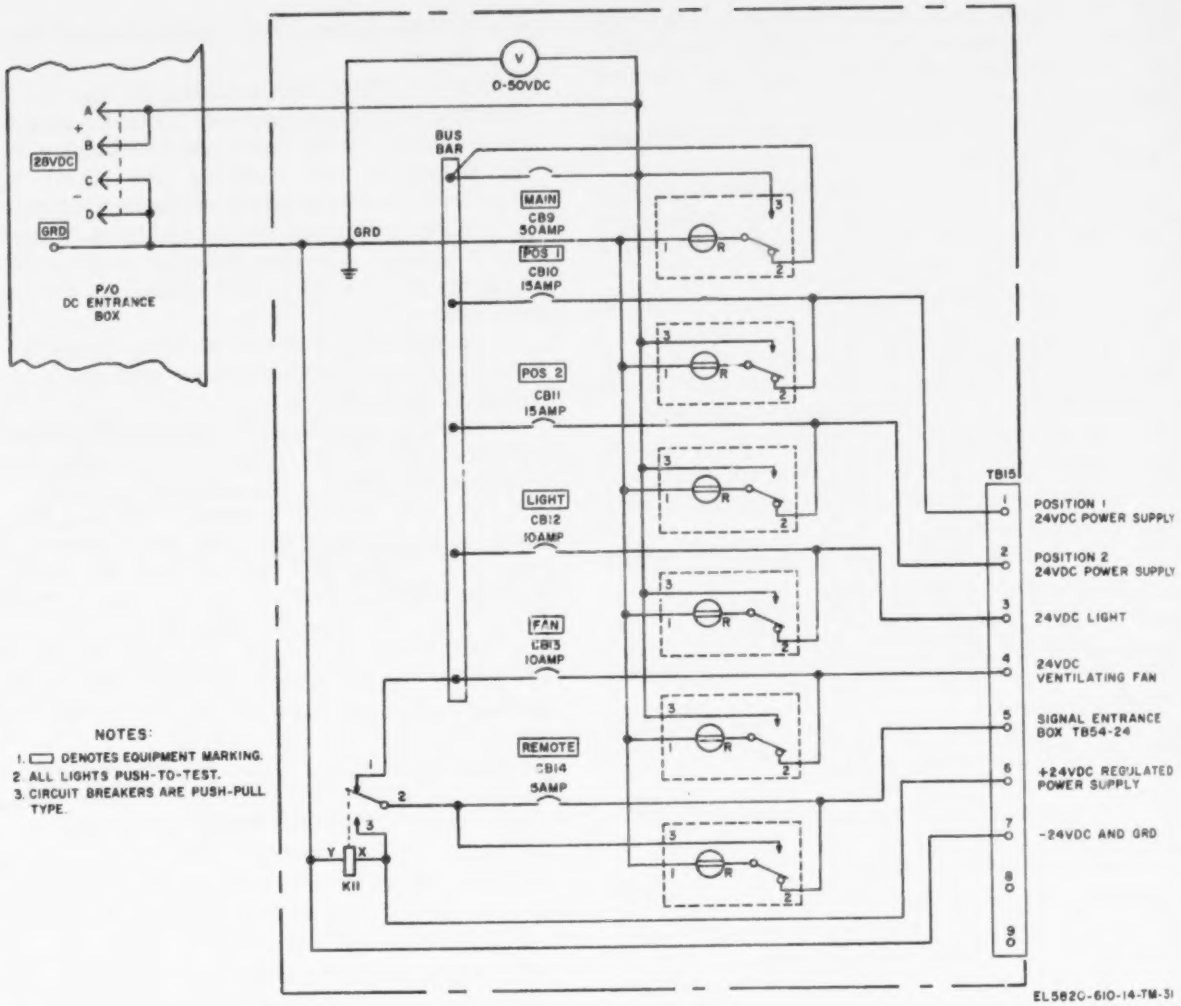
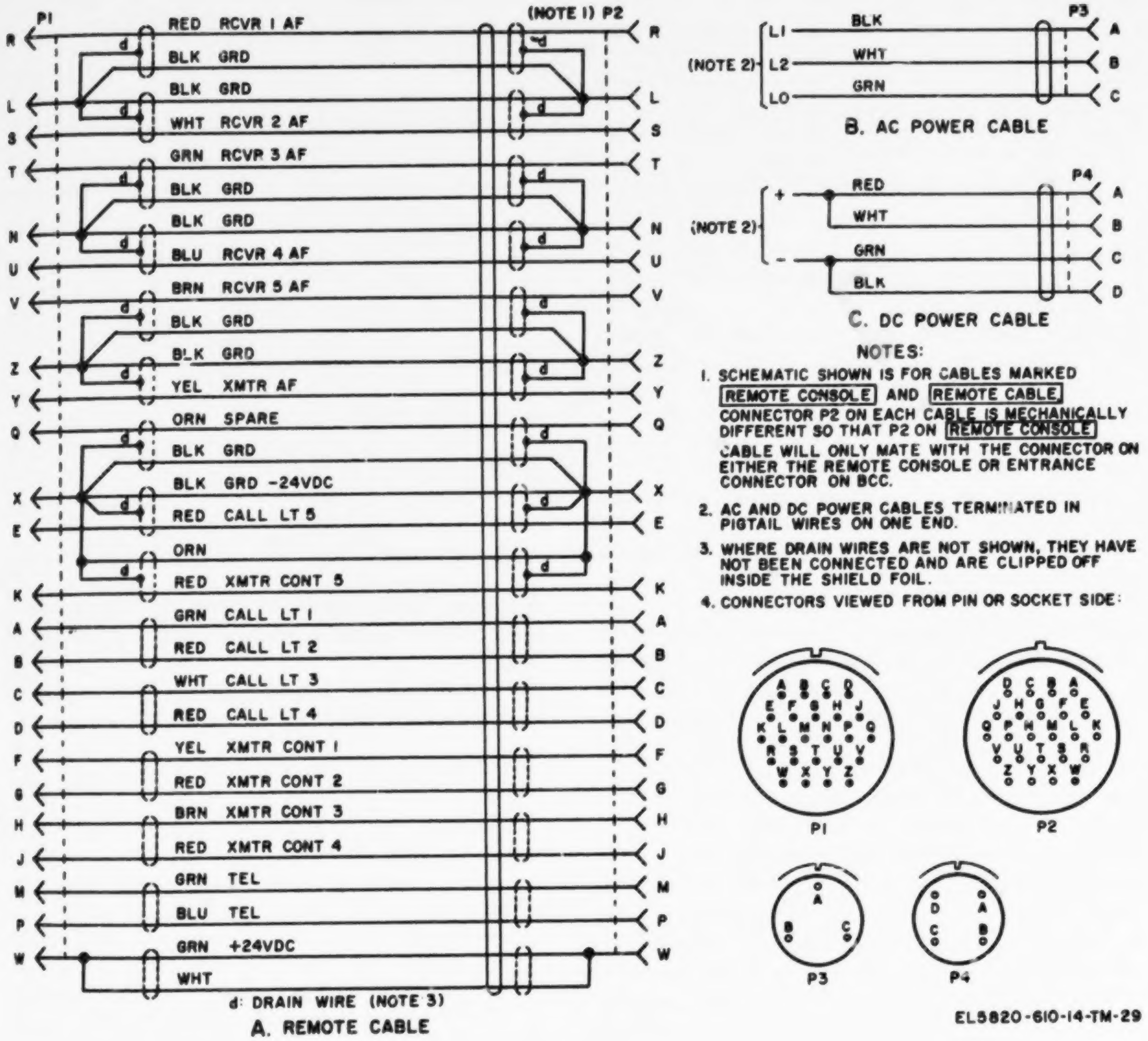

V
0-50VDC
A
+
B
28VDC
C
−
D
GRD
GRD
P/O
DC ENTRANCE
BOX
BUS
BAR
MAIN
CB9
50AMP
POS 1
CB10
15AMP
POS 2
CB11
15AMP
LIGHT
CB12
10AMP
FAN
CB13
10AMP
REMOTE
CB14
5AMP
1
2
3
R
Y
X
K11
TB15
1 POSITION 1 24VDC POWER SUPPLY
2 POSITION 2 24VDC POWER SUPPLY
3 24VDC LIGHT
4 24VDC VENTILATING FAN
5 SIGNAL ENTRANCE BOX TB54-24
6 +24VDC REGULATED POWER SUPPLY
7 -24VDC AND GRD
8
9
NOTES:
1. ▭ DENOTES EQUIPMENT MARKING.
2. ALL LIGHTS PUSH-TO-TEST.
3. CIRCUIT BREAKERS ARE PUSH-PULL TYPE.
EL5820-610-14-TM-31

Figure 4-6. Dc power distribution panel, schematic diagram.



P1
(NOTE 1) P2
RED RCVR 1 AF
BLK GRD
BLK GRD
WHT RCVR 2 AF
GRN RCVR 3 AF
BLK GRD
BLK GRD
BLU RCVR 4 AF
BRN RCVR 5 AF
BLK GRD
BLK GRD
YEL XMTR AF
ORN SPARE
BLK GRD
BLK GRD -24VDC
RED CALL LT 5
ORN
RED XMTR CONT 5
GRN CALL LT 1
RED CALL LT 2
WHT CALL LT 3
RED CALL LT 4
YEL XMTR CONT 1
RED XMTR CONT 2
BRN XMTR CONT 3
RED XMTR CONT 4
GRN TEL
BLU TEL
GRN +24VDC
WHT
R L S T N U V Z Y Q X E K A B C D F G H J M P W
d
d: DRAIN WIRE (NOTE 3)
A. REMOTE CABLE
(NOTE 2)
L1 L2 LO
BLK
WHT
GRN
P3
A B C
B. AC POWER CABLE
(NOTE 2)
+
-
RED
WHT
GRN
BLK
P4
A B C D
C. DC POWER CABLE
P1
P2
P3
P4

NOTES:

1. SCHEMATIC SHOWN IS FOR CABLES MARKED REMOTE CONSOLE AND REMOTE CABLE. CONNECTOR P2 ON EACH CABLE IS MECHANICALLY DIFFERENT SO THAT P2 ON REMOTE CONSOLE CABLE WILL ONLY MATE WITH THE CONNECTOR ON EITHER THE REMOTE CONSOLE OR ENTRANCE CONNECTOR ON BCC.
2. AC AND DC POWER CABLES TERMINATED IN PIGTAIL WIRES ON ONE END.
3. WHERE DRAIN WIRES ARE NOT SHOWN, THEY HAVE NOT BEEN CONNECTED AND ARE CLIPPED OFF INSIDE THE SHIELD FOIL.
4. CONNECTORS VIEWED FROM PIN OR SOCKET SIDE:

EL5820-610-14-TM-29

Figure 4-7. Remote control cable, schematic diagram.

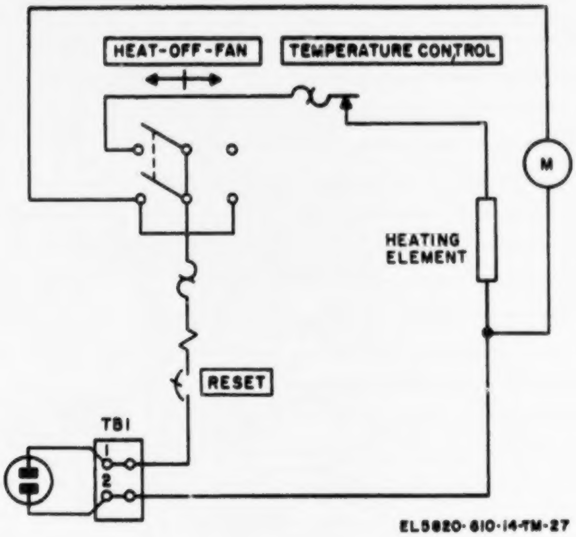

HEAT-OFF-FAN
TEMPERATURE CONTROL
M
HEATING ELEMENT
RESET
TB1
1
2
EL5820-610-14-TM-27

Figure 4-8. Electrical heater, schematic diagram.

4-26 General Support Final Test

For final test of the shelter and remote control at General Suppert, refer to the Direct Support, Electrical Test (para 4-18). Refer to Appendices A and C for maintenance data covering the individual equipment.

CHAPTER 5

SHIPMENT, LIMITED STORAGE, AND TRANSPORTATION

5-1. Preparation of Equipment

Perform the following procedures when moving Radio Terminal Set AN/TRC-133A to another site or for placing in limited storage.

a. Set all equipment power ON-OFF switches to OFF.

b. On the AC POWER DISTRIBUTION PANEL, throw all equipment circuit breakers to OFF with the exception of the MAIN and LIGHTS circuit breakers.

c. Disconnect the ac power cords from the ac receptacles. Coil and tape the communicatioms equipment ac power cords to the equipment shelves.

d. Disconnect the microphone and headsets from the transceivers and store them in one of the storage drawers.

e. Using the clamp provided, secure the handset of Telephone Set TA-312/PT firmly in place (fig. 1-6).

f. Check to be sure that the heaters are firmly fastened to their mountings.

g. Anchor the operator's chair to the mounting plate on the shelter floor. Fasten the movable seat to the chair base with the web strapping.

h. Disconnect the signal cable from the REMOTE CONTROL connector in the signal and power entrance box and from J102 on the remote control console. Roll them on the cable reels and stow them in place on the power generator trailer.

i. Disconnect the rf transmission cables from their termination connectors. Disassemble the antenna groups by reversing the procedures described in paragraphs 2-5 and 2-7. Collapse the AB-155A/U masts; coil the ropes, wires, and cables; stow the components of the doublet and whip antennas in their designated storage compartment (fig. 1-5).

j. Throw the LIGHTS and MAIN circuit breakers to OFF.

k. Shut down the ac power generator. Disconnect the ac power cable assembly from the generator and from the AC POWER connector in the AC POWER AND SIGNAL ENTRANCE BOX. Roll the power cable on the reel and anchor the assembly in place on the floor of the shelter.

l. Disconnect the ground strap; pull the grounding rod from the ground; store both items in their assigned places in the shelter.

m. Close and secure the power entrance box and vent covers on the shelter exterior.

n. Make a final check of the shelter interior. Be sure all items are firmly secured in place or properly stored. Close and lock the shelter door.

o. At the power generator trailer, be sure all items are secured firmly in place for transit.

5-2. Transportation

If the shelter is truck mounted, check to be sure that it is secured firmly in place in the truck. Use the sling as shown in figure 2-2 if the shelter is to be transported by helicopter.

APPENDIX A
REFERENCES

Following is a list of applicable references available to the operator and maintenance personnel of the radio terminal set.

AR 755-15	Disposal of Unwanted Radioactive Material.
DA Pam 310-4	Index of Technical Manuals, Technical Bulletins, Supply Manuals (types 7, 8, and 9), Supply Bulletins, and Lubrication Orders.
DA Pam 310-7	U S Army Equipment Index of Modification Work Orders.
NAVSHIPS 0969-209-3010	Dummy Load, Electrical DA-412A/U (Bird Model 8401).
CTA 50-970	Expendable Items (Except Medical, Class V, Repair Parts and Heraldic Items).
SB 708-42	Federal Supply Code for Manufacturers: United States and Canada — Code to Name (H4-2).
TB SIG 222	Solder and Soldering.
TB SIG 291	Safety Measures To Be Observed When Installing and Using Whip Antennas, Field-Type Masts, Towers and Antennas and Metal Poles That Are Used With Communication, Radar, and Direction Finder Equipment.
TB 43-0118	Field Instructions for Painting and Preserving Electronics Command Equipment including camouflage pattern painting of electrical equipment shelters.
TB 750-240	Maintenance and Repair Procedures for S-141/G, S-144/G, S-250/G, S-280/G, and S-318/G Type Shelters.
TM 5-6115-365-15	Operator, Organizational, Direct Support, General Support and Depot Maintenance Manual (Including Repair Parts and Special Tool Lists): Generator Sets, Gasoline and Diesel Engine Driven, Trailer Mounted PU-236A/G, PU-236/G, (NSN 6115-00-393-1709); PU-236B/G (NSN 6115-00-738-6334); PU-253A/U, PU-253/U (NSN 6115-00-697-2402); PU-304C/MPQ-4 (NSN 6115-00-056-8421); PU-332/G (NSN 6115-00-577-8471); PU-332A/G (NSN 6115-00-738-8336); PU-375A/G, PU-375/G (NSN 6115-00-753-2231); PU-375B/G (NSN 6115-00-931-6789); PU-401/M (NSN 6115-00-823-2217); PU-402/M (NSN 6115-00-722-3760); PU-406/M (NSN 6115-00-738-6342); PU-409/M (NSN 6115-00-702-3348); PU-409A/M (NSN 6115-00-733-6338); PU-495/G (NSN 6115-00-823-2218); PU-551/G (NSN 6115-00-889-1307); PU-564A/G (NSN 6115-00-728-6341); PU-564B/G (NSN 6115-00-179-2789); PU-617/M (NSN 6115-00-738-6335); PU-618/M (NSN 6115-00-738-6337); PU-619/M (NSN 6115-00-738-6339); PU-620/M (NSN 6115-00-738-6340); PU-625/G (NSN 6115-00-873-3915); PU-628/G (NSN 6115-00-087-0873); PU-629/G (NSN 6115-00-937-5555); PU-631/G (NSN 6115-00-059-5172); PU-656/G(NSN 6115-00-939-3296), PU-650B/G(NSN 6115-00-253-1622), and PU-656/G (NSN 6115-00-989-3296).
TM 11-809-10	Operator's Manual: Radio Transmitters T-368/URT, T-368A/URT, T-368B/URT, T-368C/URT, T-368D/URT, and T-368E/URT; Antenna Tuning Unit BC-939-B; Radio Frequency Tuner TN-339/GR.
TM 11-809-20	Organizational Maintenance: Radio Transmitters T-368/URT, T-368A/URT, T-368B/URT, T-368C/URT, T-368D/URT, and T-368E/URT; Antenna Tuning Unit BC-939-B, Radio Frequency Tuner TN-339/GR; and Standing Wave Ratio-Power Meter ME-165/G.
TM 11-5410-213-15P	Operator, Organizational, DS, GS, and Depot Maintenance Repair Parts and Special Tool Lists: Shelters, Electrical Equipment S-280A/G and S-280B/G.
TM 11-5805-201-12	Operator and Organizational Maintenance Manual: Telephone Set TA-312/PT (NSN 5805-00-543-0012).

TM 11-5805-201-35	Direct Support, General Support and Depot Maintenance Manual (Including Repair Parts and Special Tools Lists): Telephone Set TA-312/PT (NSN 5805-00-543-0012).
TM 11-5820-251-10P	Basic Issue Items List: Mast AB-155/U, AB-155A/U, and AB-155B/U.
TM 11-5820-251-14P	Operator's, Organizational, Direct Support, and General Support Maintenance Repair Parts and Special Tools Lists (Including Depot Maintenance Repair Parts and Special Tools): Masts AB-155/U (FSN 5820-251-2366). AB-155A/U (FSN 5985-507-6261), and AB-155B/U (FSN 5985-732-5146).
TM 11-5820-257-12P	Operator and Organizational Maintenance Repair Parts and Special Tool Lists and Maintenance Allocation Chart: Antenna Tuning Units BC-939-A and BC-939-B, and Tuner, Radio Frequency TN-339/GR.
TM 11-5820-257-35P	Field and Depot Maintenance Repair Parts and Special Tool Lists: Antenna Tuning Units BC-939-A and BC-939-B and Tuner, Radio Frequency TN-339/GR.
TM 11-5820-520-12	Operator and Organizational Maintenance Manual: Radio Sets AN/GRC-106 (NSN 5820-00-402-2263) and AN/GRC-106A (NSN 5820-00-223-7548).
TM 11-5820-554-12	Operator's and Organizational Maintenance Manual: Radio Set AN/FRC-93(V)1 (NSN 5820-01-054-9106); AN/FRC-93(V)2 (NSN 5820-01-052-1438; AN/FRC-93(V)3 (NSN 5820-01-052-1439); AN/FRC-93(V)4 (NSN 5820-01-053-5535); AN/FRC-93(V)5 (NSN 5820-01-052-1440); (V)6; AN/FRC-93 (NSN 5820-01-052-1441); AN/FRC(V)7 (NSN 5820-01-052-1442).
TM 11-5820-554-34-1	Direct and General Support Maintenance Manual: Amplifier, Radio Frequency AM-3979/FRC-93 (Collins Model 30L-1) (NSN 5820-00-082-4081).
TM 11-5820-554-34-2	Direct and General Support Maintenance Manual: Control, Radio Set C-6118/FRC-93 (NSN 5820-00-082-4082) and Control, Radio Set C-7515/FRC-93 (NSN 5820-00-702-2216).
TM 11-5820-554-34-3	Direct Support and General Support Maintenance Manual: Receiver-Transmitter, Radio RT-718/FRC-93 (Collins KWM-2/2A) (NSN 5820-00-082-4080).
TM 11-5820-554-34-4	Direct Support and General Support Maintenance Manual: Power Supply PP-3990/FRC-93 (Collins PM-2) (NSN 5820-00-985-8171) Power Supply PP-4151/FRC-93 (Collins 516F-2) (NSN 5820-00-034-4239) Power Supply PP-4765/GRC-159(V) (Collins 516E2) (NSN 6130-00-926-7805) Power Supply 12-Volt Input (Collins MP-1) (NSN 5820-00-034-4233).
TM 11-5820-554-34-5	Direct Support and General Support Maintenance Manual: Waters Q-Multiplier/Notch Filter Model 340A (NSN 5915-00-911-2333).
TM 11-5820-554-34-6	Direct Support and General Support Maintenance Manual: Regulator, Voltage CN-1146/FRC-93 (Sola Electric 36-189) (NSN 6110-00-930-0400).
TM 11-5820-554-34-7	Direct Support and General Support Maintenance Manual: Regulator, Voltage CN-1214/G (NSN 6110-00-832-4975).
TM 11-5820-554-34-8	Direct Support and General Support Maintenance Manual: Filter, Radio Interference F/1139/GRC-159(V) (NSN 5820-00-960-8526).
TM 11-5820-554-34-9	Direct and General Support Maintenance Manual: Coupler, Antenna CU-2004/U (Collins 180S-1) (NSN 5820-00-034-4241).
TM 11-5965-224-15P	Operator, Organizational, Field and Depot Maintenance Repair Parts and Special Tool Lists and Maintenance Allocation Chart: Handsets H-60/PT and H-165/U.
TM 11-5965-231-14P	Operator's Organizational, Direct Support, and General Support Maintenance Repair Parts and Special Tools Lists (Including Depot Maintenanc Repair Parts and Special Tools): Headset, Electrical H-113/U, FSN 5965-504-6370.
TM 38-750	The Army Maintenance Management System (TAMMS).
TM 750-244-2	Procedures for Destruction of Electronic Material to Prevent Enemy Us (Electronics Command).

APPENDIX B

BASIC ISSUE ITEMS LIST (BIIL) AND ITEMS TROOP INSTALLED OR AUTHORIZED LIST (ITIAL)

Section I. INTRODUCTION

B-1. Scope

This appendix lists basic issue items required by the crew/operator for installation, operation, and maintenance of Radio Terminal Set AN/TRC-133A.

B-2. General

This Basic Issue Items and Items Troop Installed or Authorized List is divided into the following sections:

a. Basic Issue Items List—Section II. A list, in alphabetical sequence, of items which are furnished with, and which must be turned in with the end item.

b. Items Troop Installed or Authorized List—Section III. Not applicable.

B-3. Explanation of Columns

The following provides an explanation of columns found in the tabular listings:

a. Illustration. This column is divided as follows:

(1) *Figure number.* Indicates the figure number of the illustration in which the item is shown.

(2) *Item number.* Not applicable.

b. Federal Stock Number. Indicates the Federal stock number assigned to the item and will be used for requisitioning purposes.

c. Description. Indicates the Federal item name and, if required, a minimum descreption to identify the item. The last line for each item indicates the part number with the FSCM in parentheses.

(1) *Part number.* Indicates the primary number used by the manufacturer (individual, company firm, corporation, or government activity), which controls the design and characteristics of the item by means of its engineering drawings, specifications standards, and inspection requirements, to identify an item or range of items.

(2) *Federal supply code for manufacturer (FSCM).* The FSCM is a 5-digit numeric code listed in SB 708-42 which is used to identify the manufacturer, distributor, or Government agency, etc.

d. Unit of Measure (U/M). Not applicable.

e. Quantity Furnished with Equipment (Basic Issue Items Only). Indicates the quantity of the basic issue item furnished with the equipment.

f. Quantity Authorized (Items Troop Installed or Authorized Only). Not applicable.

B-4. Special Information

Not applicable.

SECTION II. BASIC ISSUE ITEMS LIST

(1) ILLUSTRATION		(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION		(4) QTY FURN WITH EQUIP
(A) FIG. NO.	(B) ITEM NO.		PART NUMBER & FSCM	USABLE ON CODE	
1-1		4210-727-8111	AXE, FIRE: FED GGG TYPE A-926 (81349)		1
		4210-383-7129	EXTINGUISHER, FIRE: W/BRACKET; 5 lb; 5T-2 (83612)		1
1-2		5120-243-2957	HAMMER, HAND: 10 lbs SLEDGE BLACKSMITH; 8504-10 (57068)		1
2-5			INSULATOR, ELECTRICAL: modified NS5B5018, w/ring; TAD P/N QR66-32-5 (98313)		15
2-5			INSULATOR, ELECTRICAL: NS5B5018; modified; TAD P/N QR66-32-6 (98313)		50
1-14		6545-922-1200	KIT, FIRST AID: LOUISVILLE MEDICAL DEPOT; (81349)		1
		5340-802-7406	PADLOCK, YALE: 774-42B (03563)		1
2-3		5410-805-5533	SLING, MULTIPLE LEG: WIRE ROPE TYPE: 4 LEGS (NOT INSTALLED) SC-D-36423 (80063)		1
2-2			STRAP ASSEMBLY, MODIFIED: SM350233; TAD P/N QR66-32-25 (98313)		2

APPENDIX C

MAINTENANCE ALLOCATION

Section I. INTRODUCTION

C-1. General

This appendix provides a summary of the maintenance operations for AN/TRC-133A. It authorizes categories of maintenance for specific maintenance functions on repairable items and components and the tools and equipment required to perform each function. This appendix may be used as an aid in planning maintenance operations.

C-2. Maintenance Function

Maintenance functions will be limited to and defined as follows:

a. Inspect. To determine the serviceability of an item by comparing its physical, mechanical, and/or electrical characteristics with established standards through examination.

b. Test. To verify serviceability and to detect incipient failure by measuring the mechanical or electrical characteristics of an item and comparing those characteristics with prescribed standards.

c. Service. Operations required periodically to keep an item in proper operating condition i.e., to clean (decontaminate), to preserve, to drain, to paint, or to replenish fuel, lubricants, hydraulic fluids, or compressed air supplies.

d. Adjust. To maintain, within prescribed limits, by bringing into proper or exact position, or by setting the operating characteristics to the specified parameters.

e. Align. To adjust specified variable elements of an item to bring about optimum or desired performance.

f. Calibrate. To determine and cause corrections to be made or to be adjusted on instruments or test measuring and diagnostic equipments used in precision measurement. Consists of comparisons of two instruments, one of which is a certified standard of known accuracy, to detect and adjust any discrepancy in the accuracy of the instrument being compared.

g. Install. The act of emplacing, seating, or fixing into position an item, part, module (component or assembly) in a manner to allow the proper functioning of the equipment or system.

h. Replace. The act of substituting a serviceable like type part, subassembly, or module (component or assembly) for an unserviceable counterpart.

i. Repair. The application of maintenance services (inspect, test, service, adjust, align, calibrate, replace) or other maintenance actions (welding, grinding, riveting, straightening, facing, remachining, or resurfacing) to restore serviceability to an item by correcting specific damage, fault, malfunction, or failure in a part, subassembly, module (component or assembly), end item, or system.

j. Overhaul. That maintenance effort (service/action) necessary to restore an item to a completely serviceable/operational condition as prescribed by maintenance standards (i.e., DMWR) in appropriate technical publications. Overhaul is normally the highest degree of maintenance performed by the Army. Overhaul does not normally return an item to like new condition.

k. Rebuild. Consists of those services/actions necessary for the restoration of unserviceable equipment to a like new condition in accordance with original manufacturing standards. Rebuild is the highest degree of materiel maintenance applied to Army equipment. The rebuild operation includes the act of returning to zero those age measurements (hours, miles, etc.) considered in classifying Army equipments/components.

C-3. Column Entries

a. Column 1, Group Number. Column 1 lists group numbers, the purpose of which is to identify components, assemblies, subassemblies, and modules with the next higher assembly.

b. Column 2, Component/Assembly. Column 2 contains the noun names of components, assemblies, subassemblies, and modules for which maintenance is authorized.

c. Column 3, Maintenance Functions. Column 3 lists the functions to be performed on the item listed in column 2. When items are listed without maintenance functions, it is solely for purpose of having the group numbers in the MAC and RPSTL coincide.

d. Column 4, Maintenance Category. Column 4 specifies, by the listing of a "work time" figure in the appropriate subcolumn(s), the lowest level of maintenance authorized to perform the function listed in column 3. This figure represents the active time required to perform that maintenance function at the indicated category of maintenance. If the number or complexity of the tasks within the listed maintenance function vary at different maintenance categories, appropriate "worktime" figures will be shown for each category. The number of task-hours specified by the "worktime" figure represents the average time required to restore an item (assembly, subassembly, component, module, end item or system) to a serviceable condition under typical field operating conditions. This time includes preparation time, troubleshooting time, and quality assurance/quality control time in addition to the time required to perform the specific tasks identified for the maintenance functions authorized in the maintenance allocation chart. Subcolumns of column 4 are as follows:

C–Operator/Crew
O–Organizational
F–Direct Support
H–General Support
D–Depot

e. Column 5, Tools and Equipment. Column 5 specifies by code, those common tool sets (not individual tools) and special tools, test, and support equipment required to perform the designated function.

f. Column 6, Remarks. Column 6 contains an alphabetic code which leads to the remark in section IV, Remarks, which is pertinent to the item opposite the particular code.

C–4. Tool and Test Equipment Requirements (sec III)

a. Tool or Test Equipment Reference Code. The numbers in this column coincide with the numbers used in the tools and equipment column of the MAC. The numbers indicate the applicable tool or test equipment for the maintenance functions.

b. Maintenance Category. The codes in this column indicate the maintenance category allocated the tool or test equipment.

c. Nomenclature. This column lists the noun name and nomenclature of the tools and test equipment required to perform the maintenance functions.

d. National/NATO Stock Number. This column lists the National/NATO stock number of the specific tool or test equipment.

e. Tool Number. This column lists the manufacturer's part number of the tool followed by the Federal Supply Code for manufacturers (5-digit) in parentheses.

C–5. Remarks (sec IV)

a. Reference Code. This code refers to the appropriate item in section II, column 6.

b. Remarks. This column provides the required explanatory information necessary to clarify items appearing in section II.

(Next printed page is C–3)

SECTION II MAINTENANCE ALLOCATION CHART FOR

RADIO TERMINAL SET AN/TRC-133A

(1) GROUP NUMBER	(2) COMPONENT/ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY					(5) TOOLS AND EQPT.	(6) REMARKS
			C	O	F	H	D		
00	RADIO TERMINAL SET AN/TRC-133A	Inspect		0.5					
		Test		2.0				1	A
		Test			4.0			1,5 thru 8	B
		Test				6.0		1,5 thru 10	
		Service		1.0				2	
		Adjust		1.5				2	
		Repair		6.0				1,2	A
		Repair			8.0			1 thru 8	B
		Repair				10.0		1 thru 8	
		Overhaul					40.0	1 thru 10	
01	SHELTER, ELECTRONIC EQUIPMENT S-280A (MODIFIED)	Repair			4.0			1 thru 8	C
0101	DC POWER DISTRIBUTION SYSTEM	Repair			1.0			1 thru 4	
010101	DC POWER DISTRIBUTION PANEL	Repair			0.5			1 thru 4	
010102	DC POWER ENTRANCE	Repair			0.5			1 thru 4	
0102	AC POWER DISTRIBUTION SYSTEM	Repair			1.0			1 thru 4	
010201	AC POWER AND SIGNAL ENTRANCE PANEL	Repair			0.5			1 thru 4	
01020101	SIGNAL LIGHT CONTROL	Replace			0.5			3,4	
		Repair				1.0		1 thru 10	
010202	AC POWER PANEL	Repair			0.5			1 thru 4	
0103	RF INPUT SELECTOR	Repair			1.0			1 thru 4	
0104	110 VAC - 28 VDC SELECTOR SWITCH	Repair			1.0			1 thru 4	
0105	110 VAC -28 VDC SELECTOR SWITCH								
0106	WHIP ANT SWITCH	Repair			1.0			1 thru 4	
0107	WHIP ANT SWITCH								
0108	RF SWITCHING RELAY BOX	Repair			1.0			1 thru 4	
0109	RF SWITCHING RELAY BOX								
0110	RF SWITCHING RELAY BOX								
0111	REMOTE CONTROL CONSOLE	Repair			1.0			1 thru 4	
02	CABLES	Repair		0.5					
0201	CABLE ASSEMBLY, AC POWER ELECTRICAL CX-7453A/U	Replace		0.5					
		Repair			1.0			1 thru 4	
0202	POWER, ELECTRICAL CX-7705/U	Replace		0.5					
		Repair			1.0			1 thru 4	
0203	ANTENNA FEED ASSEMBLY WD3-540D	Replace		0.5					
		Repair			1.0			1 thru 4	
0204	ANTENNA FEED ASSEMBLY WD3-540D								
0205	ANTENNA FEED ASSEMBLY WD3-540D								
0206	ANTENNA FEED ASSEMBLY WD3-540D								
0207	ANTENNA FEED ASSEMBLY WD3-540D								

SECTION II MAINTENANCE ALLOCATION CHART FOR RADIO TERMINAL SET AN/TRC-133A

(1) GROUP NUMBER	(2) COMPONENT/ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY					(5) TOOLS AND EQPT.	(6) REMARKS
			C	O	F	H	D		
0208	DC POWER, ELECTRICAL WD3-536D	Replace Repair		0.5	1.0			1 thru 4	
0209	SPECIAL PURPOSE, REMOTE CONTROL CONSOLE WD3-536D								
0210	SPECIAL PUSPOSE, REMOTE CONTROL, EXTENDING WD3-536D	Replace Repair		0.5	1.0			1 thru 4	
0211	RF-1 CABLE ASSEMBLY	Replace Repair		0.5	1.0			1 thru 4	
0212	RF-1 CABLE ASSEMBLY								
0213	RF-1 CABLE ASSEMBLY								
0214	RF-1 CABLE ASSEMBLY								
0215	RF-1 CABLE ASSEMBLY								
0216	RF-1 CABLE ASSEMBLY								
0217	RF-1 CABLE ASSEMBLY								
0218	RF-1 CABLE ASSEMBLY								
0219	RF-2 CABLE ASSEMBLY	Replace Repair		0.5	1.0			1 thru 4	
0220	RF-2 CABLE ASSEMBLY								
0221	RF-3 CABLE ASSEMBLY	Replace Repair		0.5	1.0			1 thru 4	
0222	RF-3 CABLE ASSEMBLY								
0223	RF-3 CABLE ASSEMBLY								
0224	RF-3 CABLE ASSEMBLY								
0225	RF-3 CABLE ASSEMBLY								
0226	RF-3 CABLE ASSEMBLY								
0227	RF-3 CABLE ASSEMBLY								
0228	RF-3 CABLE ASSEMBLY								
0229	RF-3 CABLE ASSEMBLY								
0230	RF-3 CABLE ASSEMBLY								
0231	RF-3 CABLE ASSEMBLY								
0232	RF-3 CABLE ASSEMBLY								
0233	RF-3 CABLE ASSEMBLY								
0234	RF-3 CABLE ASSEMBLY								
0235	RF-3 CABLE ASSEMBLY								

SECTION II MAINTENANCE ALLOCATION CHART FOR

RADIO TERMINAL SET AN/TRC-133A

(1) GROUP NUMBER	(2) COMPONENT/ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY					(5) TOOLS AND EQPT.	(6) REMARKS
			C	O	F	H	D		
0236	ANTENNA CABLE ASSEMBLY EXTENSION A-1-12766D	Replace Repair		0.5	1.0			1 thru 4	
0237	ANTENNA CABLE ASSEMBLY EXTENSION A-1-12766D								
0238	ANTENNA CABLE ASSEMBLY EXTENSION A-1-12766D								
0239	ANTENNA CABLE ASSEMBLY EXTENSION A-1-12766D								
0240	ANTENNA CABLE ASSEMBLY EXTENSION A-1-12766D								
0241	ANTENNA CABLE ASSEMBLY EXTENSION A-1-12766D								
0242	ANTENNA CABLE ASSEMBLY EXTENSION A-1-12766D								
0243	ANTENNA CABLE ASSEMBLY EXTENSION A-1-12766D								
0244	ANTENNA CABLE ASSEMBLY EXTENSION A-1-12766D								
0245	ANTENNA CABLE ASSEMBLY EXTENSION A-1-12766D								
0246	ANTENNA CABLE ASSEMBLY EXTENSION A-1-12766D								
0247	ANTENNA CABLE ASSEMBLY EXTENSION A-1-12766D								
0248	ANTENNA CABLE ASSEMBLY EXTENSION A-1-12766D								
0249	ANTENNA CABLE ASSEMBLY EXTENSION A-1-12766D								
0250	ANTENNA CABLE ASSEMBLY EXTENSION A-1-12766D								
0251	ANTENNA CABLE ASSEMBLY EXTENSION A-1-12766D								
0252	ANTENNA CABLE ASSEMBLY EXTENSION A-1-12766D								
0253	ANTENNA CABLE ASSEMBLY EXTENSION A-1-12766D								
0254	ANTENNA CABLE ASSEMBLY EXTENSION A-1-12766D								
0255	ANTENNA CABLE ASSEMBLY EXTENSION A-1-12766D								
0256	ANTENNA CABLE ASSEMBLY EXTENSION A-1-12766D								
0257	ANTENNA CABLE ASSEMBLY EXTENSION A-1-12766D								
0258	ANTENNA CABLE ASSEMBLY EXTENSION A-1-12766D								
0259	ANTENNA CABLE ASSEMBLY EXTENSION A-1-12766D								
0260	ANTENNA CABLE ASSEMBLY EXTENSION A-1-12766D								

SECTION II MAINTENANCE ALLOCATION CHART FOR

RADIO TERMINAL SET AN/TRC-133A

(1) GROUP NUMBER	(2) COMPONENT/ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY					(5) TOOLS AND EQPT.	(6) REMARKS
			C	O	F	H	D		
0261	CABLE ASSEMBLY P/N 426-2027-00	Replace		0.5					
0262	CABLE ASSEMBLY P/N 426-2027-00								
0263	CABLE ASSEMBLY P/N 426-2027-00	Replace		0.5					
0264	CABLE ASSEMBLY, HIGH VOLTAGE ANTENNA WD 3-563 GR-II	Replace Repair		0.5	1.0			1 thru 4	
0265	CABLE ASSEMBLY, HIGH VOLTAGE ANTENNA WD 3-563C GR-II								
0266	EXTENSION CORD CD-307	Replace Repair		0.5	1.0			1 thru 4	
0267	EXTENSION CORD CD-307								
0268	EXTENSION CORD CD-307								
0269	EXTENSION CORD CD-307								
0270	EXTENSION CORD CD-307								
03	ANTENNA COMPONENTS	Repair			1.0			1 thru 4	
0301	WHIP ANTENNA	Repair			0.5			1 thru 4	
0302	MAST ANTENNA	Repair			0.5			1 thru 4	
030201	DOUBLET ANTENNA CONNECTOR	Repair			0.2			1 thru 4	
04	EXHAUST BLOWER	Replace Repair		0.5	2.0			2,3 1 thru 4	
05	ELECTRIC HEATER	Replace Repair		0.5	2.0			2,3 1 thru 4	

SECTION II MAINTENANCE ALLOCATION CHART FOR

RADIO TERMINAL SET AN/TRC-133A

(1) GROUP NUMBER	(2) COMPONENT/ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY					(5) TOOLS AND EQPT.	(6) REMARKS
			C	O	F	H	D		
06	RADIO SET AN/FRC-93(V)	Replace		1.0				1 thru 4	D
0601	RECEIVER-TRANSMITTER RT-718/FRC-93								
0602	CONTROL C-6118/FRC-93								
0603	MICROPHONE M-127/FRC-93								
0604	AC POWER SUPPLY PP-4151/FRC-93								
0605	CRYSTAL UNIT SET, QUARTZ CK-31/FRC-93								
0606	DC POWER SUPPLY PP-4765/GRC-159(V)								
0607	AMPLIFIER, RF AM-3979/FRC-93								
0608	DIRECTIONAL WATTMETER (COLLINS 302C-3)								
0609	DUMMY LOAD (COLLINS DL-1)								
07	RADIO SET AN/FRC-93(V)								
0701	RECEIVER-TRANSMITTER RT-718/FRC-93								
0702	CONTROL C-6118/FRC-93								
0703	MICROPHONE M-127/FRC-93								
0704	AC POWER SUPPLY PP-4151/FRC-93								
0705	CRYSTAL UNIT SET, QUARTZ CK-31/FRC-93								
0706	DC POWER SUPPLY PP-4765/GRC-159(V)								
08	RADIO SET AN/FRC-93(V)								
0801	RECEIVER-TRANSMITTER RT-718/FRC-93								
0802	CONTROL C-6118/FRC-93								
0803	MICROPHONE M-127/FRC-93								
0804	AC POWER SUPPLY PP-4151/FRC-93								
0805	CRYSTAL UNIT SET, QUARTZ CK-31/FRC-93								
09	RADIO SET AN/FRC-93(V)								
0901	RECEIVER-TRANSMITTER RT-718/FRC-93								
0902	CONTROL C-6118/FRC-93								
0903	MICROPHONE M-127/FRC-93								
0904	AC POWER SUPPLY PP-4152/FRC-93								
0905	CRYSTAL UNIT SET, QUARTZ CK-31/FRC-93								
10	RADIO SET AN/FRC-93(V)								
1001	RECEIVER-TRANSMITTER RT-718/FRC-93								
1002	CONTROL C-6118/FRC-93								
1003	MICROPHONE M-127/FRC-93								
1004	AC POWER SUPPLY PP-4151/FRC-93								
1005	CRYSTAL UNIT SET, QUARTZ CK-31/FRC-93								

SECTION II MAINTENANCE ALLOCATION CHART FOR

RADIO TERMINAL SET AN/TRC-133A

(1) GROUP NUMBER	(2) COMPONENT/ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY					(5) TOOLS AND EQPT.	(6) REMARKS
			C	O	F	H	D		
11	TUNER, RF TN-339/GR	Replace		0.5				1 thru 4	E
12	TUNER, RF TN-339/GR								
13	TELEPHONE TA-312/PT	Replace		0.5				1 thru 4	F
14	DC POWER SUPPLY (RB 23-6.0)	Replace Repair		0.5		2.0		1 thru 4 1 thru 10	
15	DUMMY LOAD, ELECTRICAL DA-75/U	Replace Repair		0.5	1.0			2,3 1 thru 4	
16	DUMMY LOAD, ELECTRICAL DA-412/U	Replace Repair		0.5	1.0			2,3 1 thru 4	

SECTION III TOOL AND TEST EQUIPMENT REQUIREMENTS FOR

RADIO TERMINAL SET AN/TRC-133A

TOOL OR TEST EQUIPMENT REF CODE	MAINTENANCE CATEGORY	NOMENCLATURE	NATIONAL/NATO STOCK NUMBER	TOOL NUMBER
1	O,F,H,D	MULTIMETER AN/USM-223	6625-00-990-7465	
2	O,F,H,D	TOOL KIT, ELECTRONIC EQUIPMENT TK-1010/U	5180-00-064-5178	
3	F,H,D	TOOL KIT, ELECTRONIC EQUIPMENT TK-1000/U	5180-00-605-0079	
4	F,H,D	TOOL KIT, ELECTRONIC EQUIPMENT TK-1050/U	5180-00-610-8177	
5	F,H,D	OSCILLATOR O-1025/U	6625-00-318-4659	
6	F,H,D	OSCILLOSCOPE AN/USM-140A/U	6625-00-987-6603	
7	F,H,D	RESISTANCE BRIDGE ZM-4/U	6625-00-166-0398	
8	F,H,D	MULTIMETER ME-26D/U	6625-00-913-9781	
9	H,D	SPECTRUM ANALYZER TS-723D/U	6625-00-668-9418	
10	H,D	REPAIR KIT, PRINTED WIRING BOARD MK-722/U	5999-00-757-7042	

NOTE

FOR ALL LEVELS OF MAINTENANCE, SUBSTITUTE (REPLACEMENT) TOOLS AND TEST EQUIPMENT MAY BE USED IN SUPPORT OF END ITEM.

SECTION IV. REMARKS

REFERENCE CODE	REMARKS
A	ORGANIZATIONAL TEST IS LIMITED TO EQUIPMENT OPERATION AND CONTINUITY TESTING. ORGANIZATIONAL REPAIR IS LIMITED TO REPLACEMENT OF COMPONENTS INDICATED. TOOLS AND TEST EQUIPMENT FOR ORGANIZATIONAL MAINTENANCE OF IN-END-ITEM COMPONENTS ARE AUTHORIZED.
B	DIRECT SUPPORT MAINTENANCE INCLUDES ORGANIZATIONAL MAINTENANCE, REPAIR OF INDIVIDUAL END-ITEM COMPONENTS AS FOUND IN STATED TM, AND REPAIR TO SHELTER ASSEMBLIES AS INDICATED BELOW.
C	ALSO REFER TO TM 11-5410-213-14P FOR MAINTENANCE ALLOCATION OF S-280A.
D	FOR MAINTENANCE ALLOCATION REFER TO TM 11-5820-554-12.
E	FOR MAINTENANCE ALLOCATION REFER TO TM 11-5820-257-12P.
F	FOR MAINTENANCE ALLOCATION REFER TO TM 11-5805-201-12.

APPENDIX E

MAINTENANCE INSTRUCTION SHEETS

NOTES

1. This appendix contains information required by the operator or maintenance technician when operating or maintaining the following equipments:

   a. Section I, Directional Wattmeter, OD-4/GRC-159(V).

   b. Section II, Dummy Load, Collins Model DL-1.

   c. Section III, Electrical Dummy Load, DA-412A/U.

   d. Section IV, Electrical Dummy Load, DA-75/U.

   e. Section V, Terminal Protective Device and Connections.

   f. Section VI, Electric Space Heater, Valad Model P15D.

2. The technical information and material contained in Sections I and II herein has been furnished by Collins Radio Company of Cedar Rapids, Iowa, that contained in Section IV herein has been furnished by BIRD Electronics Corporation of Cleveland (Solon), Ohio, and that contained in Section VI herein has been furnished by Valad Electric Heating Corporation of Tarrytown, New York.
3. The above mentioned technical information contained in Sections I, II, IV, and VI of this appendix has been provided to the government for the purpose of operation and maintenance of the subject equipment only. Reprinting, in whole or in part, of this material outside of this manual, is not permitted without approval of the manufacturer.

Section I. DIRECTIONAL WATTMETER OD-4/GRC-159(V)

E-1. Application and Discription

Figure E-1 is a schematic diagram of OD-4/GRC-159(V) directional wattmeter. The OD-4/GRC-159(V) measures up to 2 kilowatts of forward and 2 kilowatts of reflected power on 52-ohm transmission lines (RG-8/U, or equivalent). The instrument is accurate to within ±10% (±5% nominal) over the 2- to 30-MHz range. Power loss and mismatch introduced by the instrument are negligible.

E-2. Installation

a. Mount the coupler unit adjacent to the transmission line, keeping the distance between the transmitter output and the input to the coupler unit to a minimum.

b. Cut the transmission line where it passes the coupler and install two type N male connectors at the break.

c. Place the indicator unit not more than 5 feet from the coupler. Solder the tinned cable leads to the proper terminals on the coupler as shown in figure E-1.

d. Connect the transmission line from the antenna to the end of the coupler unit which has the dc output terminals. Connect the line from the transmitter to the opposite end of the coupler unit.

e. The instrument is now ready for operation.

E-3. Operation

The actual transmitter output power that can be handled safely is relative to the swr (standing wave ratio) on the line. If the swr is extremely high, as when the line is open or shorted, it is possible to obtain forward power greater than 2 kw with practically no power output from the transmitter. Therefore, to avoid damaging the instrument, the following operating procedure should be followed carefully.

a. Set the REFLECTED-FORWARD power switch (fig. D-7) to the FORWARD 2000 scale.

b. Turn on the transmitter and excite the transmission line (and the antenna or other load). Use am. or cw emission. The indicating meter should show a forward power indication.

c. If the forward power reading is below 200 watts, either switch to the FORWARD 200 scale or increase the power output of the transmitter until an indication of midscale or greater is obtained. If the forward power indication is greater than 2000 watts (off-scale), reduce the power output of the transmitter until an on-scale indication is obtained. Record the indication.

d. Switch to the REFLECTED 2000 scale. Unless the antenna or load is perfectly matched (52 ohms resistive), the meter will indicate a reflected power. The reflected power indication will always be less than the forward power indication. If the indication is less than 200 watts, switch to the REFLECTED 200-watt scale. Record the indication. Figure E–2 is a vswr chart. Use the recorded indications and figure E–2 to determine vswr.

NOTE

> If the reflected power indication is greater than the forward power indication, the coupler unit has been improperly installed. Either the coupler has been installed backwards (the input and output type N connectors attached to the wrong side of the line) or pairs of dc meter leads to the indicator are reversed.

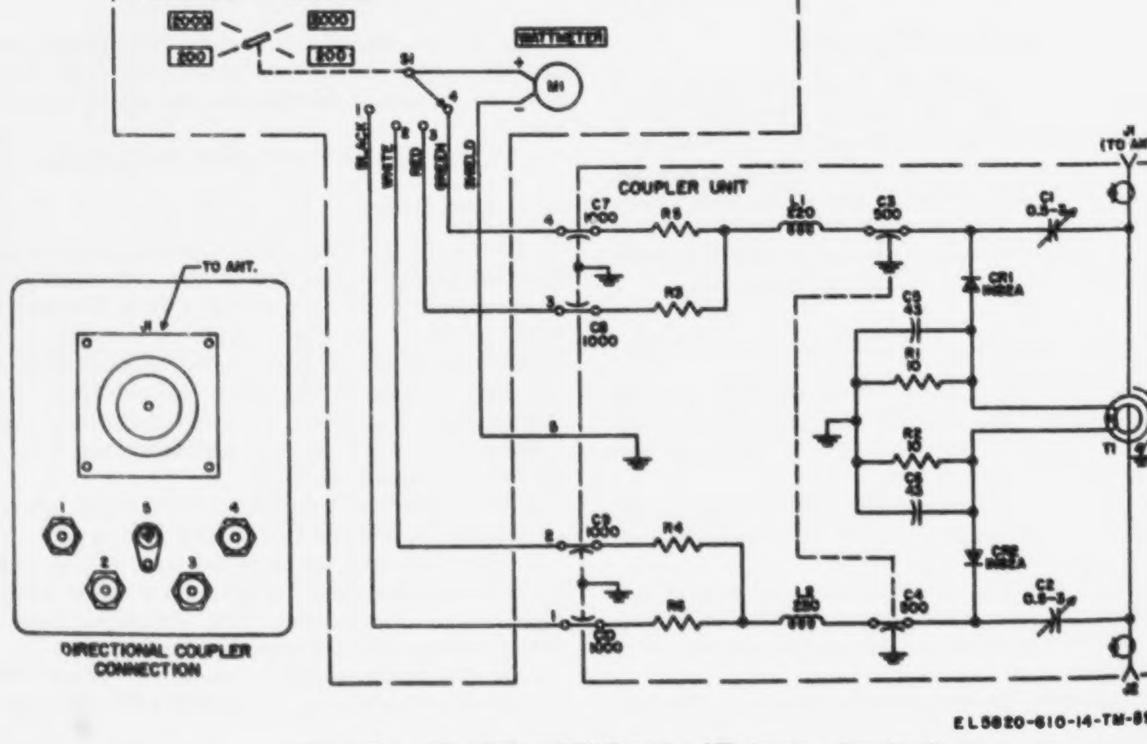
e. If the forward and reflected power readings are equal or nearly equal, the swr on the line is extremely high. This indicates a shorted, open, or poorly terminated line.

NOTE

> **The instrument will respond to submultiple and harmonic rf output from the transmitter as well as to rf at the fundamental frequency. Forward and reflected rf power on spurious frequencies will be indicated on the meter, along with rf power at the fundamental frequency. It is therefore possible to have a high swr indication in the case where the transmission line is terminated properly, but the transmitter has a high level of spurious output, such as parasitic oscillation.**

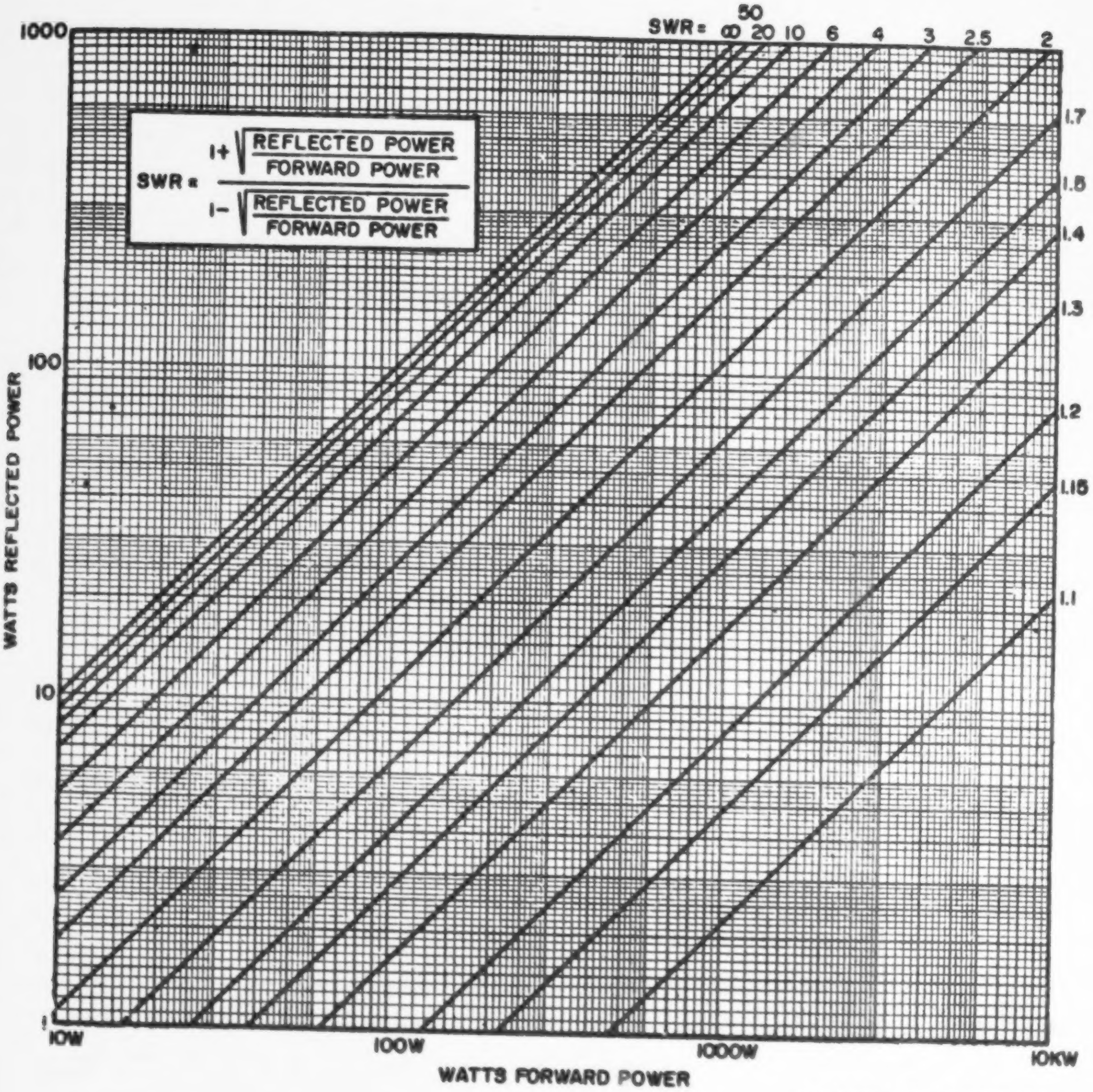
E–4. Specifications

Frequency range	2 to 30 MHz.
Impedance	52 ohms unbalanced.
Wattmeter scales	200 watts forward. 2000 watts forward. 200 watts reflected. 2000 watts reflected
Maximum power handling capability	2000 watts forward power.
Power loss through coupler	Less than 0.1% or 2 watts with 2000-watt rf output.
Swr introduced by coupler	Less than 1.05:1.
Weight	Indicator 1.75 lb. Coupler 1.5 lb.
Size	Indicator 6¾ x 4 x 4. Coupler 4 x 2 x 2½


REFLECTED
FORWARD
SWITCH AND METER BOX
2000
200
2000
200
WATTMETER
S1
M1
BLACK
WHITE
RED
GREEN
SHIELD
COUPLER UNIT
C7 1000
R5
L1 250
C3 500
C1 0.5-3μf
J1 (TO ANT)
CR1 IN82A
C5 43
R1 10
R2 10
C6 43
T1
CR2 IN82A
C2 0.5-3μf
J2
C4 500
L2 250
R6
R4
R3
C9 1000
C8 1000
C10 1000
TO ANT.
J1
DIRECTIONAL COUPLER CONNECTION

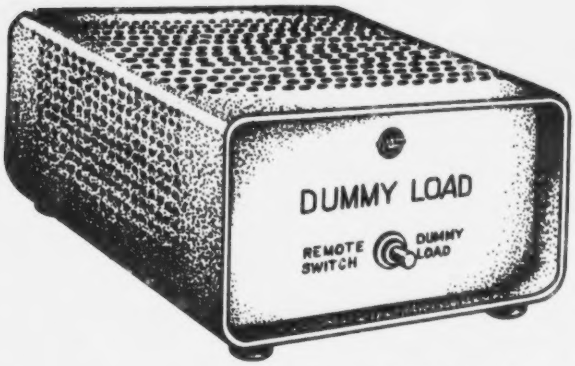
EL5820-610-14-TM-89

Figure E–1. OD–4/GRC–159(V) Directional Wattmeter, schematic diagram.



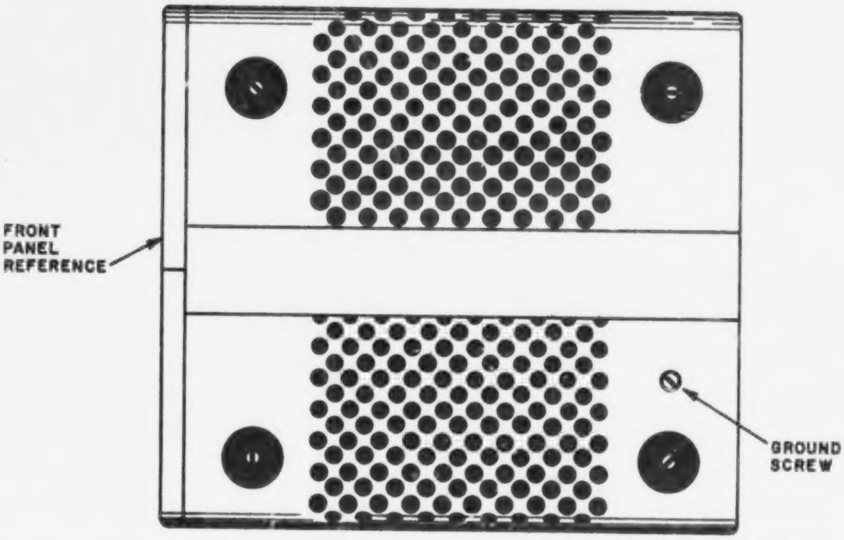
EL5820-610-14-TM-60

Figure E-2. Vswr chart.


DUMMY LOAD
REMOTE SWITCH
DUMMY LOAD

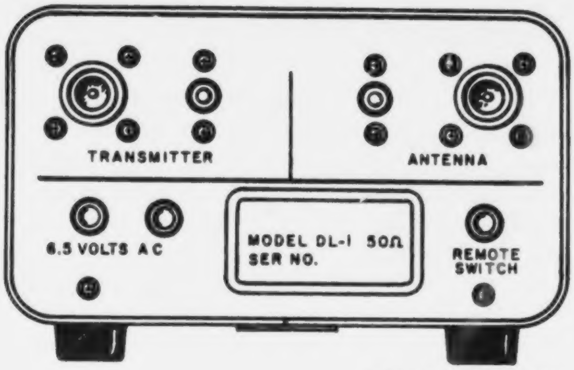
EL5820-610-14-TM-64

Figure E-3. DL-1 dummy load.


FRONT PANEL REFERENCE
GROUND SCREW

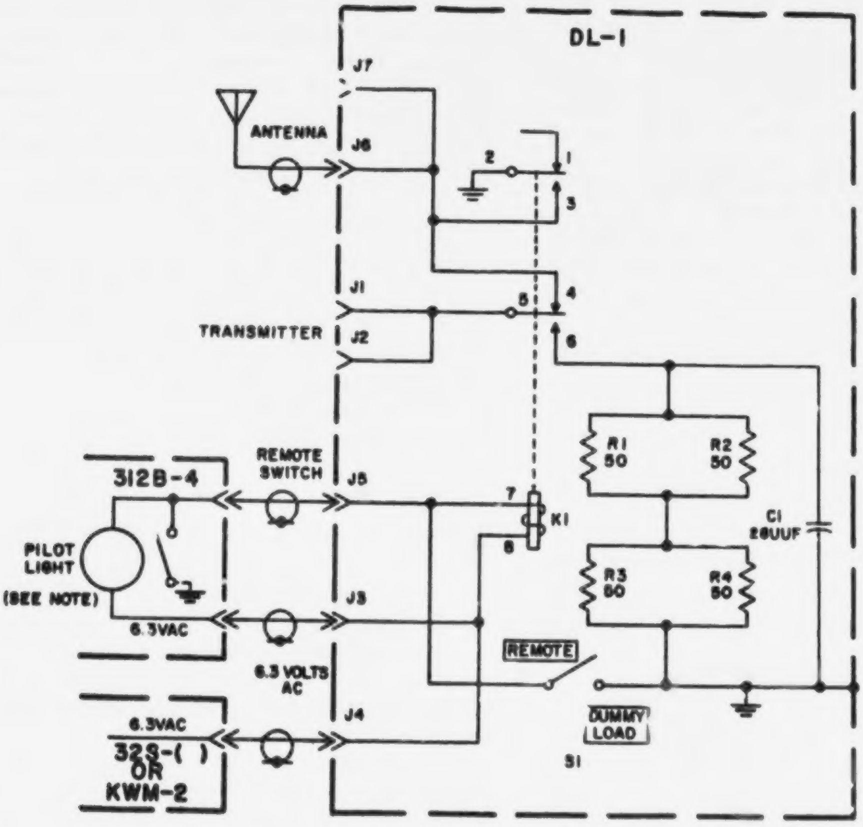
EL5820-610-14-TM-65

Figure E-4. DL-1, bottom view.


TRANSMITTER
ANTENNA
6.5 VOLTS AC
MODEL DL-1 50Ω
SER NO.
REMOTE
SWITCH

EL5820-610-14-TM-66

Figure E-5. DL-1, rear view.


DL-1
J7
ANTENNA
J6
2
1
3
J1
5
4
TRANSMITTER
J2
6
R1
50
R2
50
R3
50
R4
50
C1
26UUF
312B-4
REMOTE
SWITCH
J5
7
K1
8
PILOT
LIGHT
(SEE NOTE)
6.3VAC
J3
REMOTE
6.3 VOLTS
AC
DUMMY
LOAD
S1
6.3VAC
J4
32S-( )
OR
KWM-2

NOTE: PILOT LAMP, ITS SOCKET, AND THE SPST SWITCH SHOWN IN 312B-4 ARE NOT STOCKED BY COLLINS RADIO, BUT MAY BE PROCURED LOCALLY IN MOST AREAS. THE LAMP SOCKET MUST BE THE UNGROUNDED TYPE. THESE PARTS MUST BE ADDED TO 312B-4, ALONG WITH A JACK (SAME TYPE AS J3). THE 6.3VAC JACKS ARE ALREADY INSTALLED.

EL5820-610-14-TM-68

Figure E-6. DL-1, dummy load, schematic diagram.

Section II. DL-1 DUMMY LOAD

E-5. Description

The DL-1 (fig. E-3) is a 100-watt resistor load for use with any 100-watt transmitter or transceiver such as the 32S-1, 32S-3, or KWM-2. Use of this dummy load allows alignment or adjustment of transmitter circuits without sustained radiation of an interfering carrier. The DL-1 consists of four 50-ohm Globar resistors in a series-parallel arrangement to provide a 50-ohm resistive load. The DL-1 may be switched locally or remotely to select antenna or dummy load for connection to transmitter output. Jacks are provided for 6.3-volt ac, 50- to 60-Hz relay coil supply, remote switching, and transmitter and antenna connections. The unit can be set on a table or desk or mounted on any chassis or rack frame. As an alternate mounting, the four rubber feet can be removed and the unit mounted on a flat plate with four 6-32 screws.

E-6. Installation

No installation procedures are required if the unit is to be used on the operating desk or table. If the DL-1 is to be mounted on a rack frame or chassis, remove the four rubber feet, and mount with four 6-32 screws. Refer to figure E-4. Ground the case of the unit with the screw shown. Make connections to transmitter (fig. E-5), station control unit, and antenna as shown in figure E-6.

E-7. Operation.

If the DL-1 is to be operated by remote switching, set the REMOTE SWITCH-DUMMY LOAD control to REMOTE SWITCH. If the DL-1 is to be operated within reach using local control, the REMOTE SWITCH-DUMMY LOAD control and the relay will transfer the transmitter output from the antenna to the resistive load.

E-8. Circuit Description.
(fig. E-6)

When S1, or the remote switch in parallel with it, is open, the relay coil is not energized, and the normally closed contacts 4 and 5 of relay K1 connect the transmitter output to the antenna. When S1 or the remote switch is closed, the coil of K1 is energized from the 6.3-volt ac heater voltage source of the transmitter, and the antenna is connected to ground through contacts 2 and 3. With K1 energized, the transmitter output is connected through contacts 5 and 6 to the resistive load. This load consists of four Globar 50-ohm resistors in a series-parallel arrangement. The DL-1 will dissipate considerably more power than 100 watts without burning out the resistors, but it is recommended that higher loading be confined to very short periods of time.

CAUTION

> If the DL-1 is used as a dummy load for higher power transmitters such as the 30S-1, switch the transmitter to TUNE, and do not apply power to the DL-1 for more than 30 seconds at a time.

E-9. Specifications.

Relay coil input voltage	6.3 volts ac, 50 to 60 Hz.
Rf power dissipation rating	100 watts continuous. 1000 watts for 30 sec on. 5 min off.
Weight	2 Pounds, 14 ounces.
Dimensions	3-1/2 x 5-11/16 x 7-5/16 inches.

Section III. ELECTRICAL DUMMY LOAD DA-412A / U

E-10. General Description

a. Dummy Load DA-412A/U, figure E-11, is a portable, general purpose 50-ohm coaxial transmission line termination. This self-contained unit is suitable for use on either ship or shore installations operating in a horizontal plane without the need for outside power sources or additional equipment. This termination load resistor provides an accurate, dependable, and practically nonreflective dummy antenna for adjustment, standby, and testing of transmitters under nonradiating conditions from dc to 3000 MHz.

b. The DA-412A/U is rectangular in shape with transverse cooling fins spaced evenly along its entire length. The front and rear fins are made extra thick and bent outward 90° to form mounting flanges. These flanges act as supports for free standing use or mounting brackets for optional fixed installation. For this purpose, mounting holes are provided. (See Section II.)

c. The rf input connector, located on the front face of the unit, is a female N similar to UG-58A/U, but is a special "quick-change" design permitting rapid and easy interchange with other AN type connectors. Also provided is a UG-57B/U male to male (N type) adapter to permit cables with jacks such as UG-20E/U to be attached to the dummy load. The adapter is fastened to the front of the radiator by means of a spring holder.

E-11. Reference Data

Frequency range	Dc to 3000 MHz.
Vswr	1.2:1 dc - 3000 MHz.
Input impedance	50 ohms nominal.
Load power rating	600 watts continuous 900 watts for a 15-min interval (see text).
Ambient temperature range	−54°C to +64°C.

Weight	19.6 pounds.
Operating position	Horizontal only.

E-12. Equipment Supplied and Equipment Required but Not Supplied with DA-412A/U

Not applicable.

a. Equipment Supplied.

Qty per equip	*Name*	*Nomenclature*	*Dimensions*
1	Dummy Load, Electrical	DA-412A/U	16-13/16''lg x 5-15/16''w x 8-1/2''h
1	Adapter	UG-57B/U	1-5/8'' lg x 13/16'' dia
2	Instruction Book		

b. Equipment Required but not Supplied.

Qty	*Name*	*Nomenclature*	*Required use*
1	Resistance Bridge	ZM-4/U	Troubleshooting procedures

E-13. Site Selection

Locate Dummy Load DA-412A/U to provide at least 6 inches of free space around and above the unit. Place to permit the shortest possible cable length between the dummy load and the transmitting equipment.

E-14. Installation Requirements

Operate the DA-412A/U in a horizontal position only (handle on top). The dummy load may be used free-standing on any convenient flat surface. If it is desired to fasten the load by its mounting brackets, use ¼" machine screws and nuts or #12 wood screws. The four 5/16" holes in the mounting brackets are on a base rectangle of 14-5/8 by 4-1/8 inches.

E-15. Functional Operation

a. Dummy Load DA-412A/U consists essentially of a metallic film-type resistor immersed in a dielectric coolant. The resistor, individually selected for its accuracy, is enclosed in a special tapered housing which provides a linear reduction in surge impedance directly proportional to the distance along the resistor. This produces the uniform, practically reflectionless line termination over the stated frequencies of the DA-412A/U.

b. The dielectric coolant is chosen for its desirable dielectric properties and thermal characteristics. Cooling of the dummy load is accomplished by natural fluid and air convention. The dielectric coolant carries the electrically generated heat from the resistor to the walls of the cylindrical cooling tank. This tank is encased in a set of radiating fins constructed of heavy gage metal, which are firmly pressed on the cylinder. The heat from the dielectric oil is transferred to the surrounding air by the radiating fins.

c. Expansion of the coolant with the rise in temperature is allowed for by means of a synthetic rubber diaphragm (not visible) in the rear dome of the load. The breather holes in the dome are visible.

E-16. Operating Procedure

Connect the DA-412A/U to the transmitting equipment under test with 50-ohm coaxial cable such as RG-212/U or equal and a plug (UG-18E/U or equal) which mates with the rf input connector of the load. A Cable-type jack such as UG-20E/U which will mate with the UG-57B/U adapter may also be employed for the connection. After the transmitter has been connected to the dummy load, proceed according to the instructions pertaining to the specific equipment involved.

CAUTION

> DO NOT operate this equipment over the rated 600 watts continuously or over 900 watts for more than 15-minute intervals. Allow unit to cool to ambient temperature (approximately +25°C) before reusing at the 900-watt power level. Operate in a horizontal position only (handle on top).

E-17. Operator's Maintenance

a. The principal maintenance required by the operator will be the cleaning of the rf input connector and adapter. If the connector or adapter should become dirty or grimy, clean carefully with trichlorethylene on a cotton swab stick. Keep the radiator of the DA-412A/U wiped clean and free of dust.

WARNING

> Prolonged breathing of dry cleaning solvents is dangerous. Make certain adequate ventilation is provided.

b. If any portions of the radiator are corroded or rusted, clean the area carefully with a fine sandpaper and touch up with gray enamel.

E-18. Periodic Inspection

With the rugged and simple construction of the DA-412A/U dummy load, periodic inspection will be necessary at only about 6-month intervals. The inspection procedure should include the items listed below:

a. Oil Leakage. Make sure there is no indication of coolant oil seepage around the radiator tank, and particularly at the front and back around the underside of the clamping band. See paragraph E-19, Troubleshooting Chart, if leakage is observed. Check tightness of the clamping band screw and the fasteners around the front cylinder.

b. Dc Resistance. Accurate measurement of the dc resistance between the inner and outer conductors of the rf input connector will provide a good check on the condition of the load resistor. For this measurement, use a test set with an accuracy of 1 percent at 50 ohms such as ZM-4/U. The resistance measured should be a nominal 50 ohms, ± 2 ohms.

c. Inspect the DA-412A/U for completeness and general condition of the equipment.

E-19. Troubleshooting

a. Use of Troubleshooting Chart. The troubleshooting chart in *b* below lists the symptoms of the commonly encountered troubles, causes, and suggested corrective measures. The repairman should use this chart as a guide in analyzing symptoms.

b. Troubleshooting Chart.

Symptoms	*Causes*	*Remedy*
Leakage of coolant oil around clamping bands or radiator housing.	Clamping bands not tight	Tighten slightly with a screwdriver
	Faulty O-ring (front)	Replace per paragraph E-24.
	Faulty diaphragm (rear)	Replace per paragraph E-23.
Excessive overheating of the radiator.	Transmitter power too high	Reduce transmitter power.
	Coolant oil level too low	Add more coolant oil to the radiator per paragraph E-23.
	Faulty rf section assy	Replace per paragraph E-24.
High or low dc resistance values per paragraph E-18.	Faulty rf input connector	Replace per paragraph E-22.
	Loose rf input connector	Tighten with a screwdriver.
	Faulty rf section assy	Replace per paragraph E-24.
	Coolant oil level too low	Add more coolant oil to the radiator per paragraph E-23.

E-20. Preventive Maintenance

Preventive maintenance is the systematic care, servicing, and inspection of equipment to prevent the occurrence of trouble, reduce downtime, and to assure that the equipment is serviceable. The periodic inspection checks (para E-18) will serve as a good guide to preventive maintenance.

E-21. Tools Required for Repairs and Replacement

There are no special techniques required for the repair or replacement of components in Dummy Load DA-412A/U. A screwdriver will be the only tool needed. Paragraphs E-22 and E-23 below outline component removal and replacement.

E-22. Rf Input Connector Removal and Replacement

a. Connector removal.

(1) Remove the four #8-32 x 5/16" roundhead machine screws (fig. D-11) from the corners of the rf connector.

(2) Pull the connector straight out of its socket.

b. Connector Replacement.

(1) Make sure that the projecting center contact pin on the connector is carefully engaged and properly aligned with the mating socket of the load resistor input.

(2) Replace the four #8-32 x 5/16" roundhead machine screws in the corners of the rf connector.

E-23. Diaphragm and Coolant Oil Removal and Replacement

To replace or examine the coolant oil, the diaphragm must first be removed. Removal and replacement of the diaphragm and coolant oil are listed in *a* and *b* below:

a. Removal of Diaphragm and Coolant Oil.

(1) Stand the dummy load vertically, with the band end (diaphragm end) up.

(2) Loosen the clamp screw (fig. D-11) until the clamping band is released.

(3) Remove the diaphragm cover and lift the diaphragm from the back end of the radiator tank.

(4) The coolant oil level should be about 1 inch below the top of the radiator cylinder. If the oil appears to be contaminated, replace.

b. Replacement of Diaphragm and Coolant Oil.

(1) Fill the dummy load with the proper coolant oil (Appendix D) to 1 inch below the top of the radiator cylinder.

(2) Replace the diaphragm on the back end of the radiator tank and replace the diaphragm cover.

(3) Replace the clamping band and tighten the clamping screw.

E-24. Rf Section Assembly Removal and Replacement

If it should become necessary to remove the load resistor assembly, first remove the diaphragm (para E-23) and coolant oil and then proceed with the steps in *a* below.

a. Rf Section Assembly Removal.

(1) Pour the coolant oil into a CLEAN container.

(2) Set the dummy load on its mounting feet.

(3) Loosen and remove the four 8-32 x 5/16" oval head machine screws (fig. D-11) from around the cylinder (rf input connector end).

(4) With one hand, hold the load assembly by the rf input connector; using the other hand, push the assembly (from inside the radiator housing) out of the radiator.

(5) Inspect the O-ring seal (fig. D-11) which is located just inside the mounting flange of the resistor assembly. *Do not* reuse the O-ring if there is any sign of deterioration.

b. Rf Section Assembly Replacement.

(1) If O-ring seal is good or has been replaced, place the load assembly back in the radiator.

(2) Replace and tighten the four 8-32 x 5/16" oval head machine screws from around the cylinder.

(3) Replace the coolant oil (para E-23).

Section IV. ELECTRICAL DUMMY LOAD DA-75/U

E-25. Coverage of Instruction

The function, description, and operation of the Bird Model 82A Termaline Coaxial Resistor (dummy load) are covered in this appendix. In addition, procedures are provided for operating and maintaining the dummy load. These procedures include operating instructions, maintenance instructions, and instructions for testing and recalibrating the voltage standing wave ratio (vswr) characteristic for the dummy load.

E-26. Function of Dummy Load

The dummy load is a carbon film coaxial load resistor that simulates the properties of normal loads in applications involving electrical energy from the dc to the microwave range. The dummy load may be substituted for an antenna to permit tuning radiofrequency generating equipment during maintenance and routine tests, at the same time minimizing the production of radio interference.

E-27. Additional Function

The dummy load, used with a suitable indicating device, may be substituted for any normal circuit loading element in order to measure the power output of any electrical power source.

E-28. Description of Dummy Load (fig. D-12)

The dummy load is rated for a maximum power dissipation of 500 watts. The instrument may be operated at full rated power over a temperature range of −60° to +45°C without adverse effects. The dummy load is useful for frequencies in the range from direct current to 2500 MHz and has an input impedance of 51.5 ohms ± 5%. The voltage standing wave ratio (vswr) of the dummy load is 1.1 for frequencies up to 1000 MHz and less than 1.25 for frequencies from 1000 MHz to 2500 MHz. The instrument is cooled by a liquid coolant and an air convection system that removes heat radiated by external fins. The official nomenclature for the instrument is Dummy Load, Electrical DA-75A/U. The common name, dummy load, is used throughout this appendix.

E-29. Physical Description

The dummy load is a portable instrument housed in a box-like frame having external cooling fins. Brackets for mounting the instrument are attached at each end. The resistor assembly protrudes from the housing at one end of the instrument, making the input coaxial connector and oil filler plug easily accessible. Accessories supplied with the dummy load are Cord CP-17, an RG-17/U cable and Cord CP-19, and an RG-19/U cable. Both are 5-foot coaxial cables with a wattmeter connector on one end. Technical data supplied with each individual dummy load includes a factory prepared frequency versus vswr chart and the precise dc resistance value of the load stamped on the dummy load housing.

E-30. Operating Methods

Operating procedures to be performed in the course of normal use of the dummy load are detailed in this section. Three basic operating methods are detailed here including procedures for using the instrument as a dummy load with rf transmitters as a dummy antenna, to measure transmission line losses, and to measure power losses produced by insertion devices.

NOTE

> The dummy load has no operating controls and requires no preliminary adjustment prior to using.

E-31. Procedure for Using Dummy Load with Rf Transmitters

The procedure outlined below should be followed when using the instrument as a dummy load when working with transmitters.

CAUTION

> There should be at least 6 inches of clearance from surrounding obstructions to allow unrestricted transfer of heat from the dummy load to the surrounding air. This requirement is necessary where consistently high rf power values are involved to prevent early coaxial resistor failure.

a. Shut down rf power source under test and disconnect transmission line from antenna.

b. Place dummy load in level position as close to rf power source as possible.

c. Attach transmission line to dummy load with suitable adapter, using 50-ohm constant impedance connectors and transmission lines. If connectors or lines other than 50 ohms must be used, try to keep their number to a minimum and keep them located as close as possible to rf power source.

d. Switch on rf power source under test and adjust for desired power output.

e. Upon completion of tests and/or adjustments, shut off rf generator, remove dummy load, and restore transmission lines to normal service.

E-32. Procedure for Using Dummy Load in Test of Transmission Line Losses.

The procedure outlined below for measuring transmission line losses is accurate to within ±0.5 dB if the transmitter power output is kept constant throughout the test. Power readings obtained are a measure of combined effects of line attenuation and vswr losses. In some instances, the transmission line terminals may be a great distance from the rf generator. This will require two men and the use of a telephone order wire to coordinate measurements. Other arrangements are possible and will depend to a large extent on the ingenuity of the operator.

a. Perform paragraph E-31 *a* through *c*.

b. Tune up rf generator for maximum power output and record this value (P_1).

c. Shutdown rf power source and disconnect transmission line.

d. Connect transmission line to be tested between transmitter and dummy load, using necessary adapters.

e. Turn on rf generator and record new power reading P_2. Large differences between readings P_1 and P_2 are indicative of high vswr and any transmission line measurements by this method will be inaccurate.

f. Line loss in decibels can now be calculated by direct substitutuion in the following formula:

$$\text{Loss in decibels} = 10 \log \frac{P_1}{P_2}$$

g. Restore transmitter to normal service.

E-33. Procedure for Using Dummy Load to Measure Insertion Losses

Insertion devices include all connectors, cables, relays, filters, etc in use between a power source and a power output point. Insertion devices for the most part are low-loss units and will produce only minor power losses. In most instances, these devices introduce no discernible insertion loss. However, units in poor condition will show noticeable losses when connected in the circuit under test.

E-34. Procedure for Checking Insertion Losses

To check insertion loss, connect the dummy load directly to the power source and measure the power output P_1 in watts. Next, connect the dummy load at the power output point with the insertion device connected between the power source and the dummy load. Measure the power output P_2 in watts. The insertion loss in decibels can be calculated by substituting the measured power outputs in the following formula and solving.

$$\text{Insertion loss in decibels} = 10 \log \frac{P_1}{P_2}$$

E-35. Requirements for Maintenance Routines

Preventive maintenance routines required to insure proper operation of the dummy load are included in this section. Details of maintenance methods are covered in section IV.

E-36. Maintenance Routines and Intervals

Preventive maintenance routines for the dummy load are outlined in the following list. All routines listed below should be performed monthly, M.

Routine	*Interval*	*Paragraph*
Inspecting and cleaning cables and connectors	M	E-39
Inspecting oil level and adding oil	M	E-41
Measuring dc resistance of coaxial resistor	M	E-42

E-37. Purpose of Maintenance Methods

Preventive maintenance methods are designed to prevent failure of the dummy load through a system of regular inspections and overhauls. The dummy load has been ruggedly fabricated and will operate effectively for long periods of time if care is exercised not to exceed its power handling capabilities, and if maintenance procedures are followed, and irregularities are promptly corrected.

E-38. Special Tools, Apparatus, Materials

The following items, not found in an ordinary toolkit, are required to carry out the procedures detailed in this section:

Description	*Application or use*
Cloth, crocus	Cleaning cable connectors
Rags, waste	General cleaning purposes
Oil, GE 10C Transil or equivalent	Replenishing oil coolant level
Bridge, resistance	Checking dc resistance of coaxial resistor
Ohmmeter	Measuring dc resistance continuity
Container	Holding coolant oil

E-39. Procedure for Inspecting and Cleaning Cables and Connectors

Inspect coaxial cables for tightness and cleanliness. Clean connectors, if necessary, with crocus cloth and then wipe with clean waste rag to remove any metal particles.

E-40. Inspection of accessory cables

Inspect all accessory cables for breaks, cuts, fraying, deterioration, and strains. Repair or replace faulty cables as required. Perform dc resistance continuity measurements as required on cables and connectors with ohmmeter.

E-41. Procedure for Inspecting Oil Level and Adding Oil

Inspect oil coolant level and replenish, if necessary, with GE 10C Transil oil. (Refer to paragraph E-47 for detailed oil replenishment procedure.)

CAUTION

> Too frequent low oil levels indicate the need for inspection of the dummy load for leaks (para E-46).

E-42. Procedure for Measuring Dc Resistance of Coaxial Resistor

To measure dc resistance of the coaxial resistor, use any resistance bridge that is accurate to ±1% for 50-ohm values. Make measurement across load with a pair of low-loss leads from center pin of input jack to any convenient point on housing. Variations in resistance of more than 2 ohms from original value stamped on housing indicate need for a new coaxial resistor (para E-48).

E-43. Corrective Maintenance Procedures

Corrective maintenance procedures for the dummy load are detailed in this section. Corrective maintenance includes troubleshooting and overhaul procedures for the coaxial resistor, resistor housing, and connector assembly.

E-44. Replaceable Components

The following list of component parts may be readily replaced by GS maintenance personnel with standard tools.

Item	*Number*	*Description*
1	811202	Assembly, resistor housing and connector
2	81139	O-ring, front cone seal
3	24343	Assembly, band clamping
4	Std.	10-32 x 1-½ Fil. Hd. M. S.—stainless steel
5	5030	Dielectric oil—GE 10C Transil oil or equivalent

E-45. Special Tools, Apparatus, Materials

The following items, not found in an ordinary toolkit, are required to carry out the procedures detailed in this section:

Description	*Application or use*
Cloth, crocus	Cleaning connectors
O-ring	Replacement part
Chalk	Marking origin of oil seepage
Rags, waste, clean	General cleaning purposes
Solder	Repairing cracked or broken joint in housing
Soldering iron, 300-watt	Repairing cracked or broken joint in housing
Oil, GE 10C Transil or equivalent	Replenishing coolant liquid level
Container	Holding oil coolant
Resistor housing and connector assembly	Replacement part

E-46. Procedure for Correcting Oil Coolant Leakage

(fig. D-12, D-13, D-14)

Oil leaks may be caused by dropping the dummy load, a punctured diaphragm, or losse connector fittings. If the cause of oil leakage is not corrected early enough, the vswr of the dummy load will change and eventually the coaxial resistor will fail.

E-47. Sources of Oil Leaks and Corrective Measures

a. Leaks around V-clamp (fig. D-12), in most cases, may be sealed by tightening V-clamp screw.

b. Seepage around Teflon connector may be repaired by cleaning surface with crocus cloth and then replacing O-ring.

c. Broken or cracked solder joints around Teflon connector or oil filler plub may be repaired by carrying out the following procedure:

(1) Locate origin of seepage and mark with chalk.

(2) Drain oil coolant from load into clean container by removing filler plug.

(3) Clean area surrounding break with crocus cloth and wipe with clean cloth.

(4) Solder with 300-watt soldering iron.

CAUTION

> Never use a torch. The flame might cause an explosion or ignite the residual oil.

(5) Refill container to proper level with coolant preheated to 130° F. This precaution is necessary to compensate for coolant expansion caused by heat generated by rf source.

E-48. Prodedure for Replacing Coaxial Resistor Housing and Connector Assembly.

The procedure given below should be followed when the coaxial resistor must be replaced.

a. Remove oil filler plug (fig. D-12) and empty coolant liquid into clean container.

b. Loosen V-clamp screw on rf input end of load.

c. Pull out coaxial resistor assembly (fig. D-13) far enough to detach hose clamp from rear of unit.

d. Remove the four holding screws that secure input coaxial connector to coaxial resistor assembly.

e. Reassemble with new resistor assembly by reversing above procedure and refill with coolant liquid.

E-49. Procedure for Replacing Neoprene Diaphragm

(fig. D-14)

No instructions are provided for replacing the neoprene diaphragm because special tools are required to remove the protective metal cap from the unit to free the diaphragm. Care should be exercised that pointed objects do not enter the breather holes in the protective cap, as such objects may puncture the neoprene diaphragm.

E-50. System of Operation

The dummy load is a nonradiating load termination for transmission lines. The dummy load provides an impedance match for 50-ohm transmission lines and can effectively absorb rf energy without reflecting standing waves. These properties may be attributed to a coaxial resistor element that has a distributed property resistive value of 50 ohms and an impedance that remains almost constant over the entire frequency range of operation of the dummy load.

E-51. Detailed Description of Operation (fig. D-14)

The dummy load is a resistive load that has a distributed property component makeup equivalent to that of normal power terminating devices, for example, antennas. The heart of the dummy load is a carbon-film-on-ceramic coaxial resistor with a nominal impedance of 51.5 ohms which matches the characteristic impedance most commonly encountered in coaxial transmission lines. The ability of the coaxial resistor to match the impedance of transmission lines enables the dummy load to absorb rf power up to 500 watts without the creation of standing waves.

E-52. Coaxial Resistor

The active power dissipating portion of the coaxial resistor is the external surface of the carbon-film-on-ceramic element, which is connected to the center conductor of the coaxial input jack. A return path to the outer portion of coaxial input jack has been provided by a metal shell that connects the housing to the distant end of the coaxial resistor. The constant impedance properties of this assembly are a product of the shape of the metal shell and distributed resistance along the length of the ceramic resistor. Variations in circuit impedence to changes in frequency are negligible over the entire operating range of the dummy load. At frequencies below 50 MHz, the impedance of the dummy load is almost purely resistive and equal to its dc resistance. Dc resistance tolerances are within ±5% of the nominal impedance of 51.5 ohms. The low vswr introduced by the dummy load is dependent upon its ability to completely absorb the rf energy supplied across the load. The dummy load will exhibit vswr values of less than 1.1 for radio frequencies up to 1000 MHz and a vswr value of less than 1.25 for radio frequencies between 1000 MHz and 2500 MHz.

E-53. Power Measurements

The dummy load may be used to measure the rf output power from any source within its ratings with the use of suitable indicating devices. At frequencies below 30 MHz, rf power measurements can be calculated by the E^2/R method. That is, by measuring the voltage developed across the coaxial resistor with a voltage indicating device. The voltage indicating device may be a vtvm with a frequency and voltage response corresponding to the rf signal under measurement of a direct reading bolometer bridge.

E-54. Measurements for Frequencies Below 30 MHz

For frequencies below 30 MHz, the power absorbed by the dummy load may be calculated by the relation:

$W = E^2/R$

W = Power in watts

E = Voltage developed across the coaxial resistor

R = Dc resistance of the dummy load as stamped on the housing

E-55. Cooling System

The dummy load must be effectively cooled in order to operate properly over extended periods of time. Cooling is effected through the use of a liquid coolant that carries heat away from the resistive element and cooling fins that remove heat by convection from the liquid coolant and radiate the heat into the surrounding air. Cooling is also aided by convection currents in the air that supplement the radiating action of the cooling fins.

E-56. Use of Liquid Coolant

The dummy load is upplied with liquid coolant at the proper operating level. Maintaining this level is an important factor in determining the amount of power the dummy load can dissipate in the form of heat. Expansion of the coolant caused by a rise in temperature when the dummy load operates is alleviated by an expandable neoprene diaphragm located at the rear of the unit. Breather holes are provided in a protective cap, covering the diaphragm, to allow for expansion.

Section V. TERMINAL PROTECTIVE DEVICE AND CONNECTIONS

E-57. Purpose and Description of Terminal Protective Device

This section contains information to assist the maintenance technician when he is installing and troubleshooting terminal protective device (TPD) (fig. D-12). Terminal protective device (TPD) 11053186 is a transient voltage suppressor used in conjunction with each of five Control, Radio Sets C-6118/FRC-93 (312B-4) and RF Amplifier AM-3979/FRC-93 (30L-1). Connector adapters 5935-904-4050 and 5935-539-0851 enable installation of the TPD between the antenna transmission line and the unit. Breakdown voltage between the center conductor and shell (both polarities) at $I = 1.0$ ma dc is 525 volts dc ± 25.

E-58. Installation

a. Disconnect the transmission line from J1 of the directional coupler located at the back of the radio set or rf amplifier.

b. Connect the TPD to the directional coupler, using adapters 5935-904-4050 and 5935-539-0851.

c. Connect the antenna transmission line to the TPD.

d. Perform an operational test of the radio sets (TM 11-5820-529-15) and the rf amplifier (TM 11-5820-532-15).

E-59. Maintenance

The TPD is a nonrepairable assembly. Determine proper operation of the device by performing an operational test.

Section VI. ELECTRIC SPACE HEATER, VALAD MODEL P15D

E-60. Description of Heater

Electric Space Heater, Valad Model P15D is a floor-mounted 115-volt ac, single-phase 60-cycle unit. The input power requirement is 1500 watts. The heater draws 13 amperes of current and produces 5122 BTU of heat. The heater including the mounting is 12½ inches long, 10-1/8 inches wide and 12-1/8 inches deep (to top of switch).

E-61. Installation of Heater

Install the heater as indicated in *a* through *c* below:

a. Remove the bottom mounting bracket (fig. FO-9) from heater and install the bracket securely onto floor. Use four holddown bolts. Double check against any looseness in the bracket connection to the floor.

b. After mounting bottom bracket securely fastened to the floor, lock in the heater with the four quarter-turn screws provided.

c. Plug the heater power cord into a 115-volt ac outlet.

E-62. Use of Heat Fan Switch

a. To use heat and fan proceed as follows:

(1) Set the thermostat control (fig. FO-9) to desired temperature setting.

(2) Turn switch to HEAT. The thermostat will automatically cycle on and off once temperature is set by operator.

b. To use fan only, turn switch to FAN.

E-63. Repair of Heater

WARNING

Disconnect power plug prior to any repair on heater. 115 volts ac can cause injury or death.

a. Removal and Replacement of Heating Element.

(1) Remove heater from bottom mounting bracket (fig. FO-9).

(2) Remove bottom cabinet plate.

(3) Disconnect all wires from heating element terminal block.

(4) Remove four each heating element mounting screws 8-32 x 5/8" Phillips, panhead, located in front of heater cabinet (inside of louvers).

(5) Remove heating element.

(6) Install new heating element.

(7) Replace four each heating element mounting screws removed in (4) above.

(8) Reconnect all wires to heating element terminal block.

(9) Replace bottom cabinet plate.

(10) Fasten heater with the four quarter-turn screws to the bottom mounting bracket.

b. Removal and Replacement of HEAT-OFF-FAN Switch.

(1) Remove heater from bottom mounting bracket (fig. FO-9).

(2) Remove rear of cabinet held by six each 6-32 x 3/8" Phillips panhead screws.

(3) Loosen electric cable clamp (fig. FO-9) at back of heater.

(4) Slide rear of cabinet back along power cable to get at switch.

(5) Disconnect wires from switch. Tag each wire as it is removed.

(6) Remove ½-20 nut from top of heater. Remove switch.

(7) Install a good switch.

(8) Replace ½-20 nut on top of heater.

(9) Reconnect wires disconnected in (4) above to switch.

(10) Slide rear of cabinet on power cable and place rear of cabinet on cabinet and fasten down with the screws removed in (2) above.

(11) Replace heater on bottom mounting bracket.

c. Removal and Replacement of Thermostat.

(1) Remove heater from bottom mounting bracket (fig. FO-9).

(2) Remove rear of cabinet held by six each 6-32 x 3/8" Phillips panhead screws.

(3) Loosen electric cable clamp (fig. FO-9) at back of heater.

(4) Remove two each 8-32 x ½" Phillips panhead screws holding thermostat control plate and thermostat assembly.

(5) Disconnect the thermostat wires. Tag each wire as it is disconnected. Remove thermostat assembly from the heater cabinet.

(6) Place new thermostat assembly in the heater cabinet and reconnect the thermostat wires disconnected in (5) above.

(7) Replace the thermostat assembly, removed in (4) above, and the thermostat control plate. Replace and tighten the two 8-32 x ½" Phillips panhead screws.

(8) Replace rear of cabinet and fasten with the six 6-32 x 3/8" Phillips panhead screws.

(9) Retighten electric cable clamp loosened in (3) above.

(10) Replace heater on bottom mounting bracket.

d. Removal and Replacement of Motor.

(1) Remove heater from bottom mounting bracket (fig. FO-9).

(2) Remove rear of cabinet held by six each 6-32 x 3/8" Phillips panhead screws.

(3) Loosen electric cable clamp at back of heater.

(4) Disconnect the motor leads from switch and terminal board. Tag each lead as it is disconnected.

(5) Remove four each 8-32 x 3/8" Phillips panhead screws (two on each side of heater). Screws secure motor mount assembly.

(6) Remove entire motor assembly from heater.

(7) Replace good motor assembly in heater. Secure motor mount assembly with the four 8-32 x 3/8" Phillips panhead screws removed in (5) above.

(8) Reconnect the motor leads to the switch and terminal board.

(9) Replace rear of cabinet and fasten with the six 6-32 x 3/8" Phillips panhead screws.

(10) Retighten electric cable clamp loosened in (3) above.

(11) Replace heater on bottom mounting bracket.

e. Removal and Replacement of Hi-Limit Thermostat.

(1) Remove heater from bottom mounting bracket (fig. FO-9).

(2) Remove bottom cabinet plate.

(3) Disconnect wires from the hi-limit thermostat and remove two each 8-32 x ½" Phillips panhead screws.

(4) Replace good hi-limit thermostat in heater and secure with two 8-32 x ½" Phillips panhead screws removed in (3) above.

(5) Replace bottom cabinet plate.

(6) Replace heater on bottom mounting bracket.

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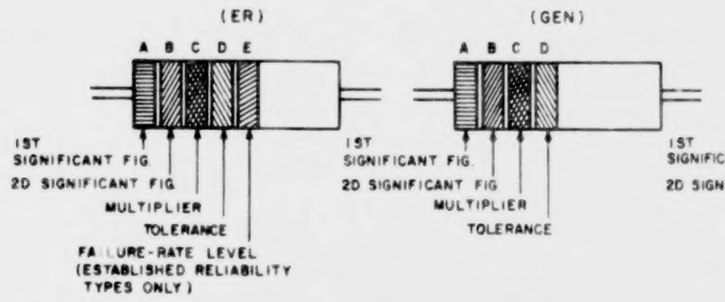
DISTRIBUTION:

To be distributed in accordance with DA Form 12-51 (qty rqr block No. 489) operator maintenance requirements for AN/TRC-133.

☆ U.S. GOVERNMENT PRINTING OFFICE : 1990 0 - 261-872 (21533)

Charts Transposed to
End of Volume.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TOLERANCE
FAILURE-RATE LEVEL (ESTABLISHED RELIABILITY TYPES ONLY)
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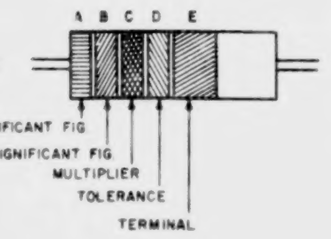
TOLERANCE

COLOR CODE MARKING FOR COMPOSITION TYPE RESISTORS.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2D SIGNIFICANT FIG
MULTIPLIER
TOLERANCE
TERMINAL

COLOR-CODE MARKING FOR FILM-TYPE RESISTORS.

TABLE 1
COLOR CODE FOR COMPOSITION TYPE AND FILM TYPE RESISTORS.

BAND A		BAND B		BAND C		BAND D		BAND E		
COLOR	FIRST SIGNIFICANT FIGURE	COLOR	SECOND SIGNIFICANT FIGURE	COLOR	MULTIPLIER	COLOR	RESISTANCE TOLERANCE (PERCENT)	COLOR	FAILURE RATE LEVEL	TERM.
BLACK	0	BLACK	0	BLACK	1			BROWN	M=1.0	
BROWN	1	BROWN	1	BROWN	10			RED	P=0.1	
RED	2	RED	2	RED	100			ORANGE	R=0.01	
ORANGE	3	ORANGE	3	ORANGE	1,000			YELLOW	S=0.001	
YELLOW	4	YELLOW	4	YELLOW	10,000	SILVER	±10 (COMP. TYPE ONLY)	WHITE	....	SOLD-ERABLE
GREEN	5	GREEN	5	GREEN	100,000	GOLD	±5			
BLUE	6	BLUE	6	BLUE	1,000,000	RED	±2 (NOT APPLICABLE TO ESTABLISHED RELIABILITY).			
PURPLE (VIOLET)	7	PURPLE (VIOLET)	7							
GRAY	8	GRAY	8	SILVER	1.01					
WHITE	9	WHITE	9	GOLD	0.1					

BAND A — THE FIRST SIGNIFICANT FIGURE OF THE RESISTANCE VALUE (BANDS A THRU D SHALL BE OF EQUAL WIDTH.)

BAND B — THE SECOND SIGNIFICANT FIGURE OF THE RESISTANCE VALUE.

BAND C — THE MULTIPLIER (THE MULTIPLIER IS THE FACTOR BY WHICH THE TWO SIGNIFICANT FIGURES ARE MULTIPLIED TO YIELD THE NOMINAL RESISTANCE VALUE.)

BAND D — THE RESISTANCE TOLERANCE.

BAND E — WHEN USED ON COMPOSITION RESISTORS, BAND E INDICATES ESTABLISHED RELIABILITY FAILURE-RATE LEVEL (PERCENT FAILURE PER 1,000 HOURS) ON FILM RESISTORS, THIS BAND SHALL BE APPROXIMATELY 1-1/2 TIMES THE WIDTH OF OTHER BANDS, AND INDICATES TYPE OF TERMINAL.

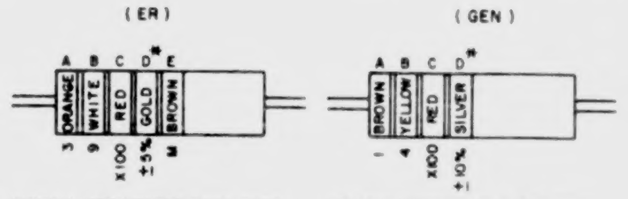
RESISTANCES IDENTIFIED BY NUMBERS AND LETTERS
(THESE ARE NOT COLOR CODED)

SOME RESISTORS ARE IDENTIFIED BY THREE OR FOUR DIGIT ALPHA NUMERIC DESIGNATORS. THE LETTER R IS USED IN PLACE OF A DECIMAL POINT WHEN FRACTIONAL VALUES OF AN OHM ARE EXPRESSED. FOR EXAMPLE:

2R7 = 2.7 OHMS   10R0 = 10.0 OHMS

FOR WIRE-WOUND-TYPE RESISTORS COLOR CODING IS NOT USED, IDENTIFICATION MARKING IS SPECIFIED IN EACH OF THE APPLICABLE SPECIFICATIONS.

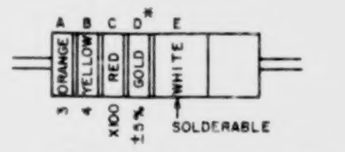
EXAMPLES OF COLOR CODING


(ER)
A B C D* E
ORANGE
WHITE
RED
GOLD
BROWN
3
9
X100
±5%
M
(GEN)
A B C D*
BROWN
YELLOW
RED
SILVER
1
4
X100
±10%

NOMINAL RESISTANCE 3,900 OHMS
RESISTANCE TOLERANCE ±5%
FAILURE RATE LEVEL M

NOMINAL RESISTANCE 1,400 OHMS
RESISTANCE TOLERANCE ±10%

COMPOSITION-TYPE RESISTORS

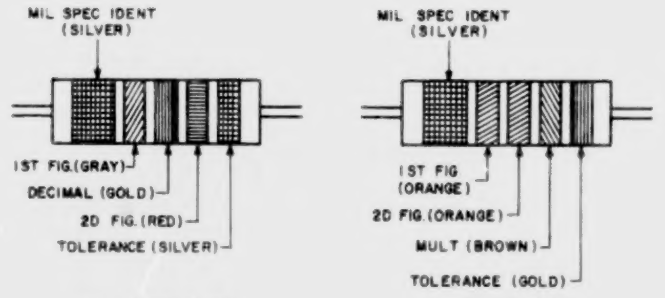

A B C D* E
ORANGE
YELLOW
RED
GOLD
WHITE
3
4
X100
±5%
SOLDERABLE

NOMINAL RESISTANCE 3,400 OHMS
RESISTANCE TOLERANCE ±5%
TERMINAL SOLDERABLE

FILM-TYPE RESISTORS

* IF BAND D IS OMITTED, THE RESISTOR TOLERANCE IS ± 20% AND THE RESISTOR IS NOT MIL-STD.

A. COLOR CODE MARKING FOR MILITARY STANDARD RESISTORS.


MIL SPEC IDENT (SILVER)
1ST FIG.(GRAY)
DECIMAL (GOLD)
2D FIG.(RED)
TOLERANCE (SILVER)
MIL SPEC IDENT (SILVER)
1ST FIG (ORANGE)
2D FIG.(ORANGE)
MULT (BROWN)
TOLERANCE (GOLD)

(A) 8.2UH ± 10%

(B) 330UH ± 5%

COLOR CODING FOR TUBULAR ENCAPSULATED R.F. CHOKES. AT A, AN EXAMPLE OF OF THE CODING FOR AN 8.2UH CHOKE IS GIVEN. AT B, THE COLOR BANDS FOR A 330 UH INDUCTOR ARE ILLUSTRATED.

TABLE 2
COLOR CODING FOR TUBULAR ENCAPSULATED R.F. CHOKES.

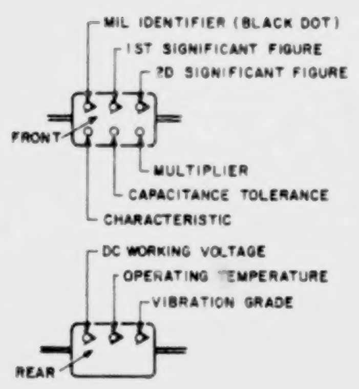
COLOR	SIGNIFICANT FIGURE	MULTIPLIER	INDUCTANCE TOLERANCE (PERCENT)
BLACK	0	1	
BROWN	1	10	1
RED	2	100	2
ORANGE	3	1,000	3
YELLOW	4		
GREEN	5		
BLUE	6		
VIOLET	7		
GRAY	8		
WHITE	9		
NONE			20
SILVER			10
GOLD	DECIMAL POINT		5

MULTIPLIER IS THE FACTOR BY WHICH THE TWO COLOR FIGURES ARE MULTIPLIED TO OBTAIN THE INDUCTANCE VALUE OF THE CHOKE COIL.

B. COLOR CODE MARKING FOR MILITARY STANDARD INDUCTORS.

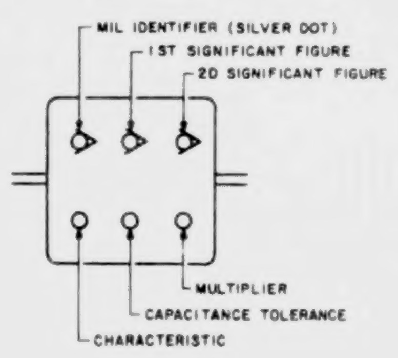
CAPACITORS, FIXED, VARIOUS-DIELECTRICS, STYLES CM, CN, CY, AND CB.

CM


MIL IDENTIFIER (BLACK DOT)
1ST SIGNIFICANT FIGURE
2D SIGNIFICANT FIGURE
FRONT
MULTIPLIER
CAPACITANCE TOLERANCE
CHARACTERISTIC
DC WORKING VOLTAGE
OPERATING TEMPERATURE
VIBRATION GRADE
REAR

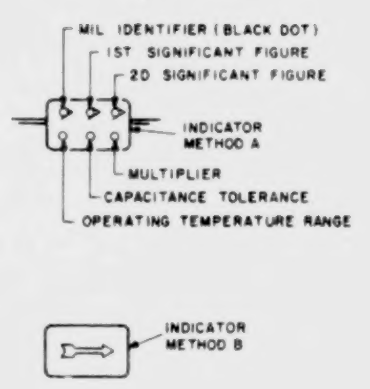
MICA-DIELECTRIC

CN


MIL IDENTIFIER (SILVER DOT)
1ST SIGNIFICANT FIGURE
2D SIGNIFICANT FIGURE
MULTIPLIER
CAPACITANCE TOLERANCE
CHARACTERISTIC

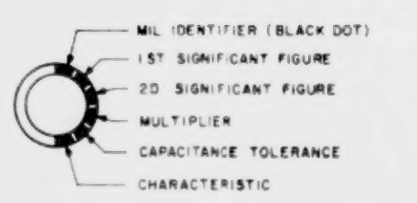
PAPER-DIELECTRIC

CY


MIL IDENTIFIER (BLACK DOT)
1ST SIGNIFICANT FIGURE
2D SIGNIFICANT FIGURE
INDICATOR METHOD A
MULTIPLIER
CAPACITANCE TOLERANCE
OPERATING TEMPERATURE RANGE
INDICATOR METHOD B

GLASS-DIELECTRIC, GLASS CASE

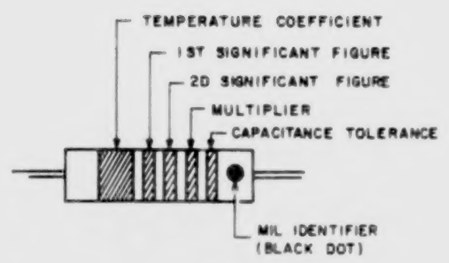
CB


MIL IDENTIFIER (BLACK DOT)
1ST SIGNIFICANT FIGURE
2D SIGNIFICANT FIGURE
MULTIPLIER
CAPACITANCE TOLERANCE
CHARACTERISTIC

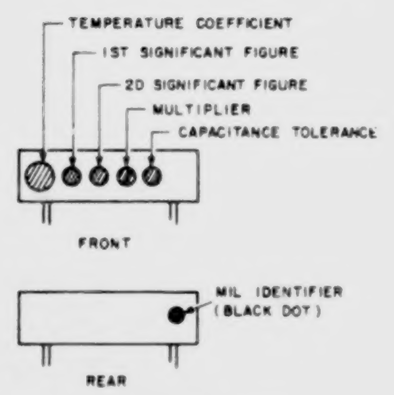
MICA, BUTTON TYPE

TABLE 3 — FOR USE WITH STYLES CM, CN, CY AND CB

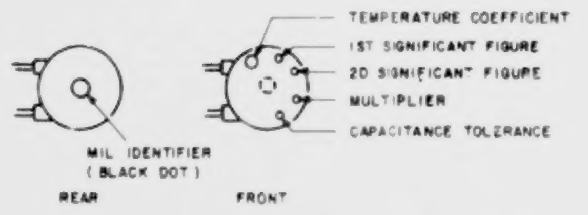
COLOR	MIL ID	1ST SIG FIG	2D SIG FIG	MULTIPLIER[1]	CAPACITANCE TOLERANCE				CHARACTERISTIC[2]			DC WORKING VOLTAGE	OPERATING TEMP RANGE	VIBRATION GRADE
					CM	CN	CY	CB	CM	CN	CB	CM	CY, CM	CM
BLACK	CM, CY CB	0	0	1			±20%	±20%		A			-55° TO +70°C	10-55 HZ
BROWN		1	1	10					B	E	B			
RED		2	2	100	±2%		±2%	±2%	C				-55° TO +85°C	
ORANGE		3	3	1,000		±30%			D		D	300		
YELLOW		4	4	10,000					E				-55° TO +125°C	10-2,000HZ
GREEN		5	5		±5%				F			500		
BLUE		6	6										-55° TO +150°C	
PURPLE (VIOLET)		7	7											
GREY		8	8											
WHITE		9	9											
GOLD				0.1			±5%	±5%						
SILVER	CN				±10%	±10%	±10%	±10%						


TEMPERATURE COEFFICIENT
1ST SIGNIFICANT FIGURE
2D SIGNIFICANT FIGURE
MULTIPLIER
CAPACITANCE TOLERANCE
MIL IDENTIFIER (BLACK DOT)

AXIAL LEAD


TEMPERATURE COEFFICIENT
1ST SIGNIFICANT FIGURE
2D SIGNIFICANT FIGURE
MULTIPLIER
CAPACITANCE TOLERANCE
FRONT
MIL IDENTIFIER (BLACK DOT)
REAR

RADIAL LEAD


TEMPERATURE COEFFICIENT
1ST SIGNIFICANT FIGURE
2D SIGNIFICANT FIGURE
MULTIPLIER
CAPACITANCE TOLERANCE
MIL IDENTIFIER (BLACK DOT)
REAR
FRONT

DISK-TYPE

TABLE 4 — TEMPERATURE COMPENSATING, STYLE CC

COLOR	TEMPERATURE COEFFICIENT[4]	1ST SIG FIG	2D SIG FIG	MULTIPLIER[1]	CAPACITANCE TOLERANCE		MIL ID
					CAPACITANCES OVER 10 UUF	CAPACITANCES 10 UUF OR LESS	
BLACK	0	0	0	1		±2.0 UUF	CC
BROWN	-30	1	1	10	±1%		
RED	-80	2	2	100	±2%	±0.25 UUF	
ORANGE	-150	3	3	1,000			
YELLOW	-220	4	4				
GREEN	-330	5	5		±5%	±0.5 UUF	
BLUE	-470	6	6				
PURPLE (VIOLET)	-750	7	7				
GREY		8	8	0.01			
WHITE		9	9	0.1	±10%		
GOLD	+100					±1.0 UUF	
SILVER							

[1] THE MULTIPLIER IS THE NUMBER BY WHICH THE TWO SIGNIFICANT (SIG) FIGURES ARE MULTIPLIED TO OBTAIN THE CAPACITANCE IN UUF

[2] LETTERS INDICATE THE CHARACTERISTICS DESIGNATED IN APPLICABLE SPECIFICATIONS MIL-C-5, MIL-C-25D, MIL-C-11272B, AND MIL-C-10950C RESPECTIVELY

[3] LETTERS INDICATE THE TEMPERATURE RANGE AND VOLTAGE-TEMPERATURE LIMITS DESIGNATED IN MIL-C-11015D

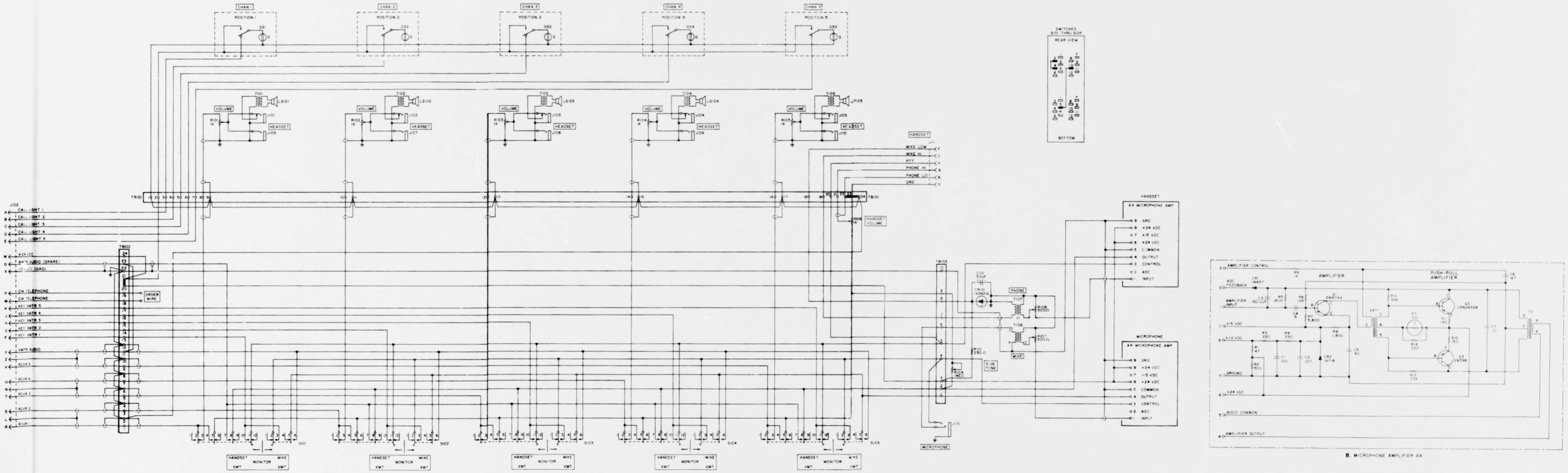
[4] TEMPERATURE COEFFICIENT IN PARTS PER MILLION PER DEGREE CENTIGRADE

C. COLOR CODE MARKING FOR MILITARY STANDARD CAPACITORS.

ESC-FM 1794-71

Figure FO-1. Color code marking for MIL-STD capacitors, inductor and resistors.

best copy available


CHAN 1
POSITION 1
DS1
CHAN 2
POSITION 2
DS2
CHAN 3
POSITION 3
DS3
CHAN 4
POSITION 4
DS4
CHAN 5
POSITION 5
DS5
VOLUME
R101 1K
T101
LS101
J101
HEADSET
J106
R102 1K
T102
LS102
J102
J107
R103 1K
T103
LS103
J103
J108
R104 1K
T104
LS104
J104
J109
R105 1K
T105
LS105
J105
J110
HANDSET
J111
MIKE LOW
MIKE HI
PTT
PHONE HI
PHONE LO
GRD
HANDSET VOLUME
TB101
J102
CALL LIGHT 1
CALL LIGHT 2
CALL LIGHT 3
CALL LIGHT 4
CALL LIGHT 5
+24 VDC
XMTR AUDIO (SPARE)
-24 VDC (GRD)
OW TELEPHONE
OW TELEPHONE
KEY XMTR 5
KEY XMTR 4
KEY XMTR 3
KEY XMTR 2
KEY XMTR 1
XMTR AUDIO
RCVR 5
RCVR 4
RCVR 3
RCVR 2
RCVR 1
TB102
ORDER WIRE
S101
S102
S103
S104
S105
HANDSET
MIKE
MONITOR
XMT
XMT
SWITCHES S101 THRU S105
REAR VIEW
BOTTOM
TB103
C101 50UF
CR101 1N3821A
PHONE
T107
R108 500Ω
T106
R107 500Ω
MIKE
R110 250Ω
R109 1MEG
SIDE TONE
J113
MICROPHONE
HANDSET
A4 MICROPHONE AMP
GRD
+24 VDC
+15 VDC
+24 VDC
COMMON
OUTPUT
CONTROL
AGC
INPUT
MICROPHONE
A4 MICROPHONE AMP
AMPLIFIER CONTROL
AGC FEEDBACK
AMPLIFIER INPUT
+15 VDC
+24 VDC
GROUND
+24 VDC
AUDIO COMMON
AMPLIFIER OUTPUT
AMPLIFIER
PUSH-PULL AMPLIFIER
CR1 1N457
C3 150 UUF
R5 180K
R6 12K
C4 8
R7 5,600
Q1 2N404A
R9 1K
R3 330
R4 330
R1 47
R2 300
C1 100
C2 100
CR2 1N718
R8 1,800
C5 40
A4T1
R10 33K
Q2 USN2N399
RT1 30
R14 220
R11 150
R12 150
Q3 2N398
R13 33K
C7 .01
C6 47
T2

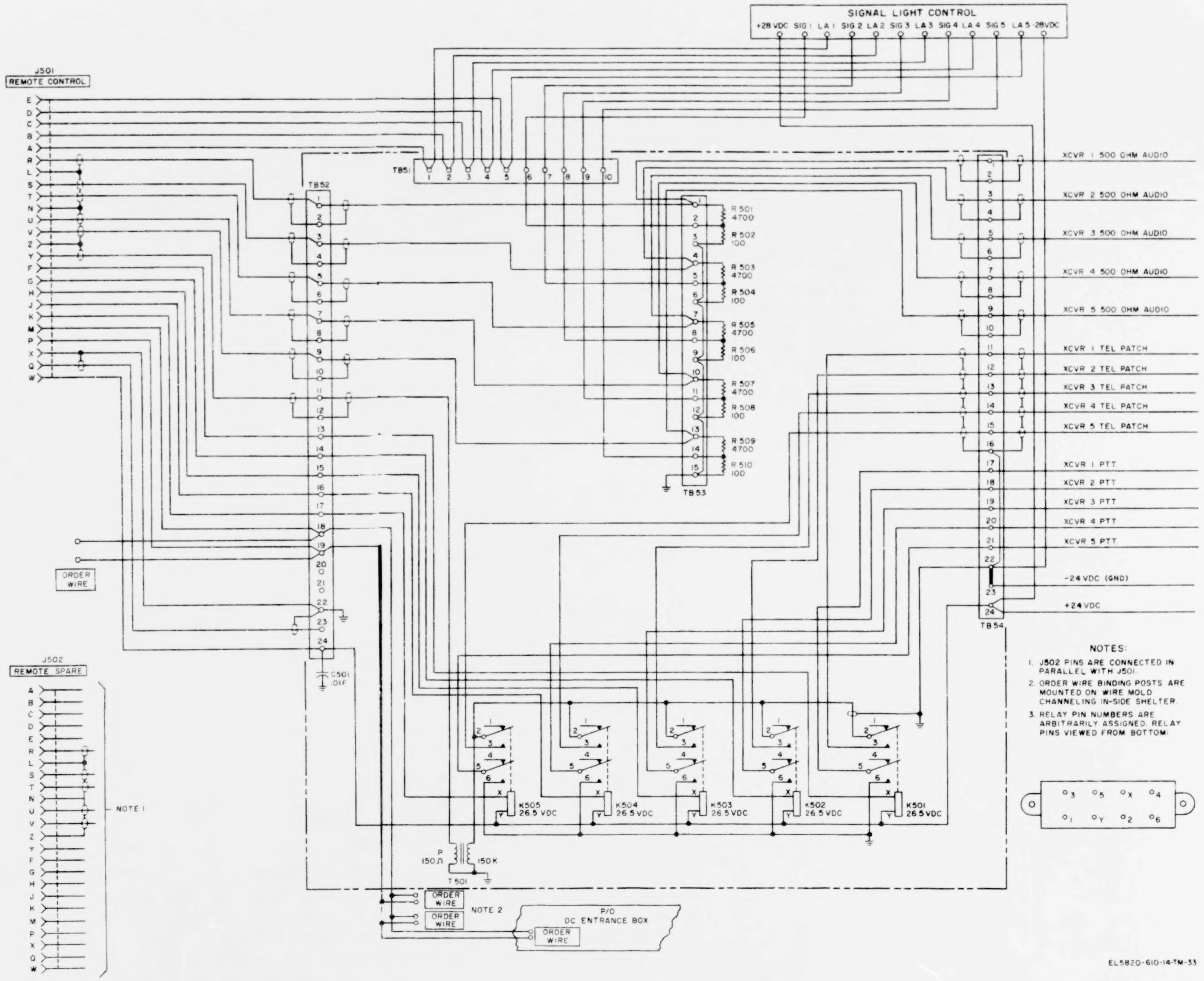
A. CONTROL PORTION

B. MICROPHONE AMPLIFIER A4

NOTE
UNLESS OTHERWISE INDICATED, RESISTANCES ARE IN OHMS, AND CAPACITANCES ARE IN UF.

EL5820-610-14-TM-28

Figure FO-2. Remote control console, schematic diagram.

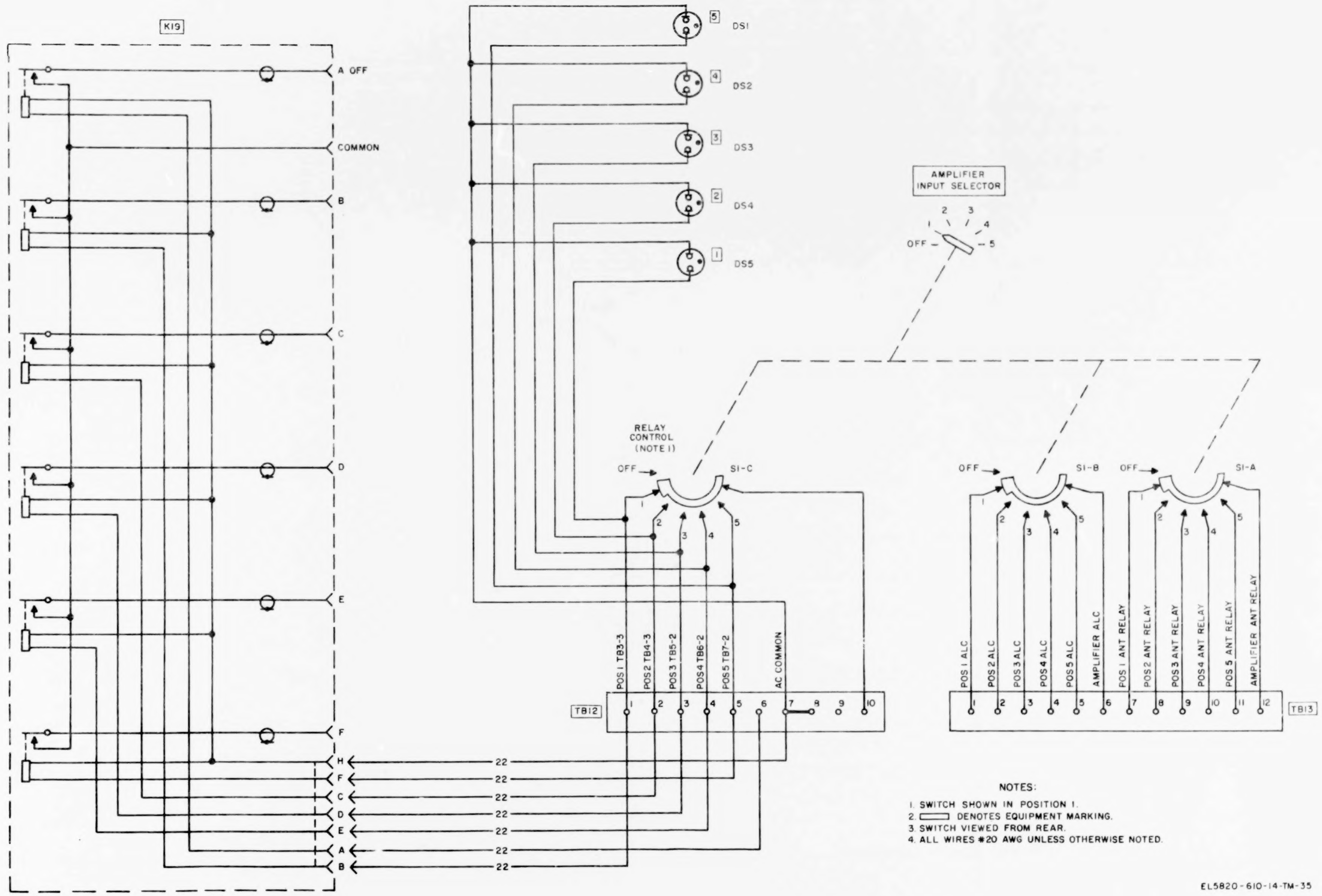

SIGNAL LIGHT CONTROL
+28 VDC SIG 1 LA 1 SIG 2 LA 2 SIG 3 LA 3 SIG 4 LA 4 SIG 5 LA 5 -28VDC
J501
REMOTE CONTROL
E D C B A R L S T N U V Z Y F G H J K M P X Q W
TB51
TB52
TB53
TB54
R 501 4700
R 502 100
R 503 4700
R 504 100
R 505 4700
R 506 100
R 507 4700
R 508 100
R 509 4700
R 510 100
XCVR 1 500 OHM AUDIO
XCVR 2 500 OHM AUDIO
XCVR 3 500 OHM AUDIO
XCVR 4 500 OHM AUDIO
XCVR 5 500 OHM AUDIO
XCVR 1 TEL PATCH
XCVR 2 TEL PATCH
XCVR 3 TEL PATCH
XCVR 4 TEL PATCH
XCVR 5 TEL PATCH
XCVR 1 PTT
XCVR 2 PTT
XCVR 3 PTT
XCVR 4 PTT
XCVR 5 PTT
-24 VDC (GND)
+24 VDC
ORDER WIRE
C501 .01F
J502
REMOTE SPARE
A B C D E R L S T N U V Z Y F G H J K M P X Q W
NOTE 1
K505 26.5 VDC
K504 26.5 VDC
K503 26.5 VDC
K502 26.5 VDC
K501 26.5 VDC
P 150Ω
150K
T501
ORDER WIRE
ORDER WIRE
NOTE 2
P/O DC ENTRANCE BOX
ORDER WIRE
3 5 X 4
1 Y 2 6

NOTES:

1. J502 PINS ARE CONNECTED IN PARALLEL WITH J501.
2. ORDER WIRE BINDING POSTS ARE MOUNTED ON WIRE MOLD CHANNELING IN-SIDE SHELTER.
3. RELAY PIN NUMBERS ARE ARBITRARILY ASSIGNED. RELAY PINS VIEWED FROM BOTTOM:

EL5820-610-14-TM-33

Figure FO-3. Ac power and signal entrance box, schematic diagram.

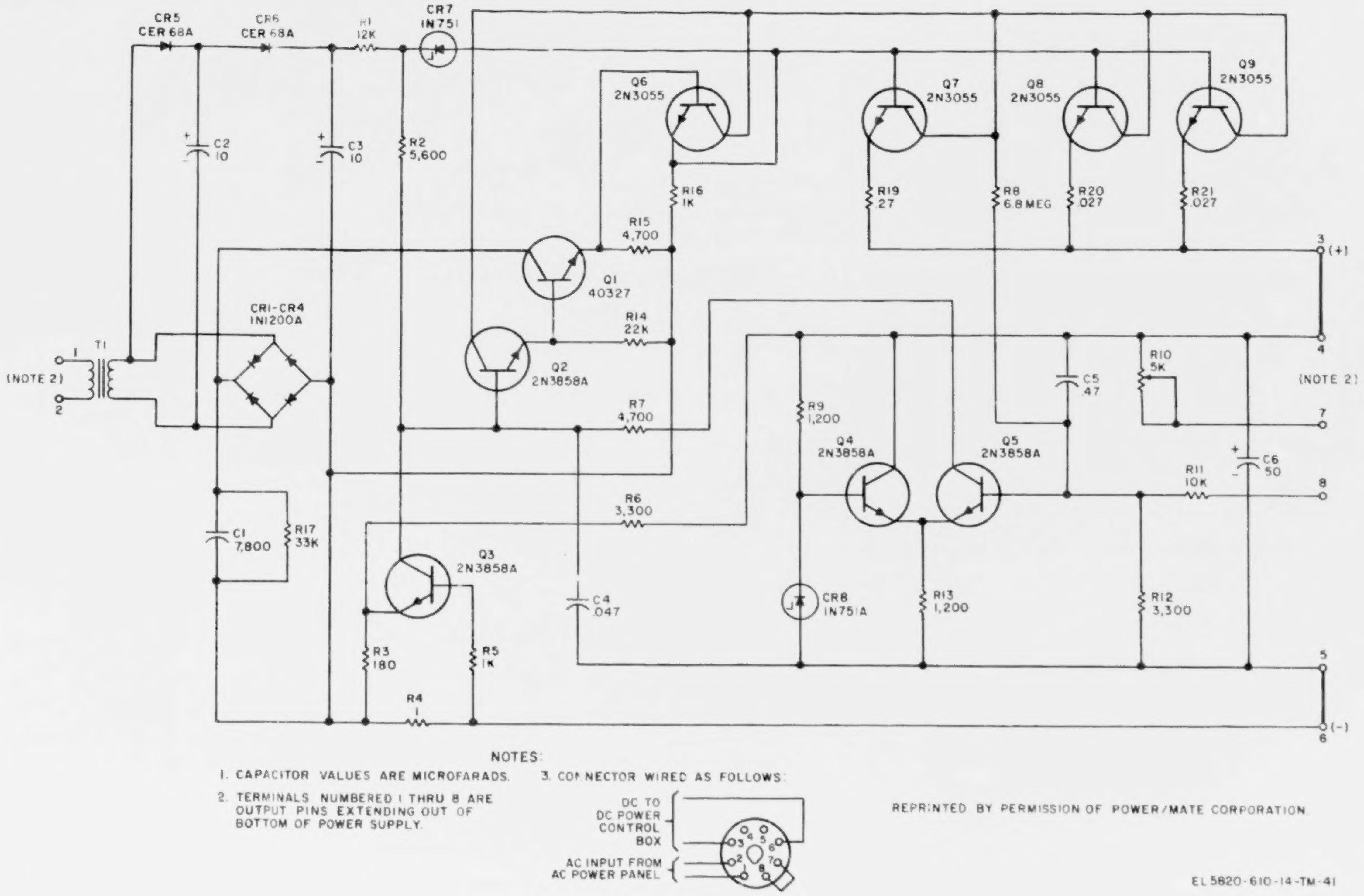

K19
A OFF
COMMON
B
C
D
E
F
H
F
C
D
E
A
B
22
DS1
DS2
DS3
DS4
DS5
5
4
3
2
1
AMPLIFIER INPUT SELECTOR
OFF
1
2
3
4
5
RELAY CONTROL (NOTE 1)
S1-C
S1-B
S1-A
POS 1 TB3-3
POS 2 TB4-3
POS 3 TB5-2
POS 4 TB6-2
POS 5 TB7-2
AC COMMON
TB12
1
2
3
4
5
6
7
8
9
10
POS 1 ALC
POS 2 ALC
POS 3 ALC
POS 4 ALC
POS 5 ALC
AMPLIFIER ALC
POS 1 ANT RELAY
POS 2 ANT RELAY
POS 3 ANT RELAY
POS 4 ANT RELAY
POS 5 ANT RELAY
AMPLIFIER ANT RELAY
TB13
11
12

NOTES:

1. SWITCH SHOWN IN POSITION 1.
2. ▭ DENOTES EQUIPMENT MARKING.
3. SWITCH VIEWED FROM REAR.
4. ALL WIRES #20 AWG UNLESS OTHERWISE NOTED.

EL5820-610-14-TM-35

Figure FO-4. Rf amplifier input selector, schematic diagram.


CR5
CER 68A
CR6
CER 68A
R1
12K
CR7
IN751
C2
10
C3
10
R2
5,600
Q6
2N3055
Q7
2N3055
Q8
2N3055
Q9
2N3055
R16
1K
R19
.27
R8
6.8 MEG
R20
.027
R21
.027
R15
4,700
Q1
40327
3
(+)
CR1-CR4
IN1200A
R14
22K
Q2
2N3858A
4
1
T1
(NOTE 2)
2
R10
5K
C5
.47
(NOTE 2)
R7
4,700
R9
1,200
7
Q4
2N3858A
Q5
2N3858A
C6
50
R11
10K
8
R6
3,300
C1
7,800
R17
33K
Q3
2N3858A
C4
.047
CR8
IN751A
R13
1,200
R12
3,300
R3
180
R5
1K
5
R4
1
(-)
6
DC TO
DC POWER
CONTROL
BOX
AC INPUT FROM
AC POWER PANEL
1
2
3
4
5
6
7
8

NOTES:

1. CAPACITOR VALUES ARE MICROFARADS.
2. TERMINALS NUMBERED 1 THRU 8 ARE OUTPUT PINS EXTENDING OUT OF BOTTOM OF POWER SUPPLY.
3. CONNECTOR WIRED AS FOLLOWS:

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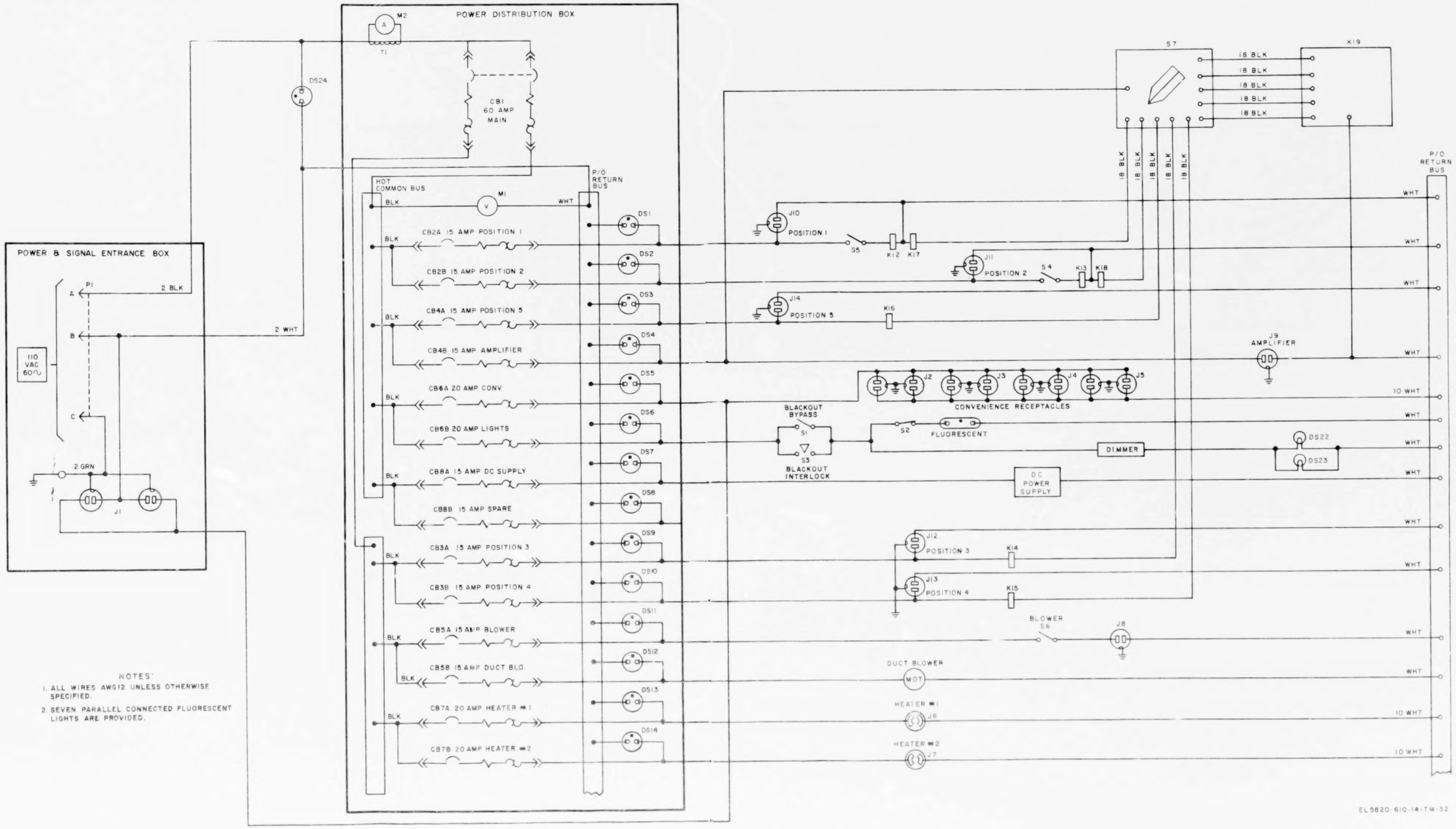
EL 5820-610-14-TM-41

Figure 4-5. 24-volt dc power supply (RB 23-6.0) schematic diagram.


POWER & SIGNAL ENTRANCE BOX
P1
A
B
C
2 BLK
2 WHT
110 VAC 60~
2 GRN
J1
DS24
POWER DISTRIBUTION BOX
M2
A
T1
CB1 60 AMP MAIN
HOT COMMON BUS
P/O RETURN BUS
BLK
M1
V
WHT
CB2A 15 AMP POSITION 1
CB2B 15 AMP POSITION 2
CB4A 15 AMP POSITION 5
CB4B 15 AMP AMPLIFIER
CB6A 20 AMP CONV
CB6B 20 AMP LIGHTS
CB8A 15 AMP DC SUPPLY
CB8B 15 AMP SPARE
CB3A 15 AMP POSITION 3
CB3B 15 AMP POSITION 4
CB5A 15 AMP BLOWER
CB5B 15 AMP DUCT BLO.
CB7A 20 AMP HEATER #1
CB7B 20 AMP HEATER #2
DS1
DS2
DS3
DS4
DS5
DS6
DS7
DS8
DS9
DS10
DS11
DS12
DS13
DS14
S7
K19
18 BLK
J10
POSITION 1
S5
K12
K17
J11
POSITION 2
S4
K13
K18
J14
POSITION 5
K16
J9
AMPLIFIER
J2
J3
J4
J5
CONVENIENCE RECEPTACLES
BLACKOUT BYPASS
S1
S3
BLACKOUT INTERLOCK
S2
FLUORESCENT
DIMMER
DS22
DS23
DC POWER SUPPLY
J12
POSITION 3
K14
J13
POSITION 4
K15
BLOWER S6
J8
DUCT BLOWER
MOT
HEATER #1
J6
HEATER #2
J7
WHT
10 WHT
EL5820-610-14-TM-32

NOTES:

1. ALL WIRES AWG12 UNLESS OTHERWISE SPECIFIED.
2. SEVEN PARALLEL CONNECTED FLUORESCENT LIGHTS ARE PROVIDED.

Figure FO-5. Ac power distribution diagram.

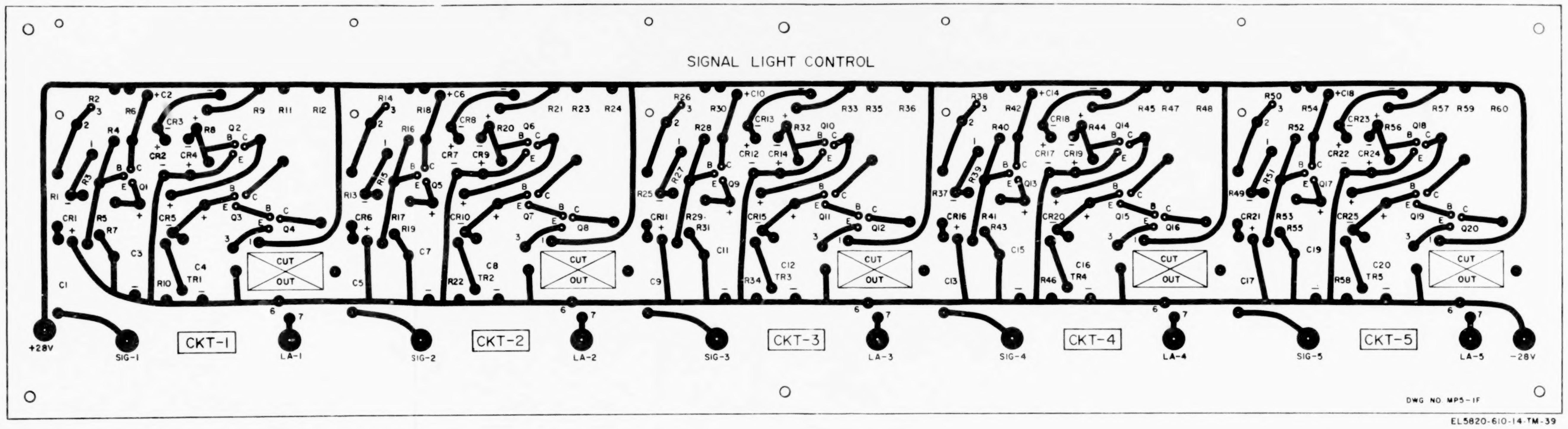
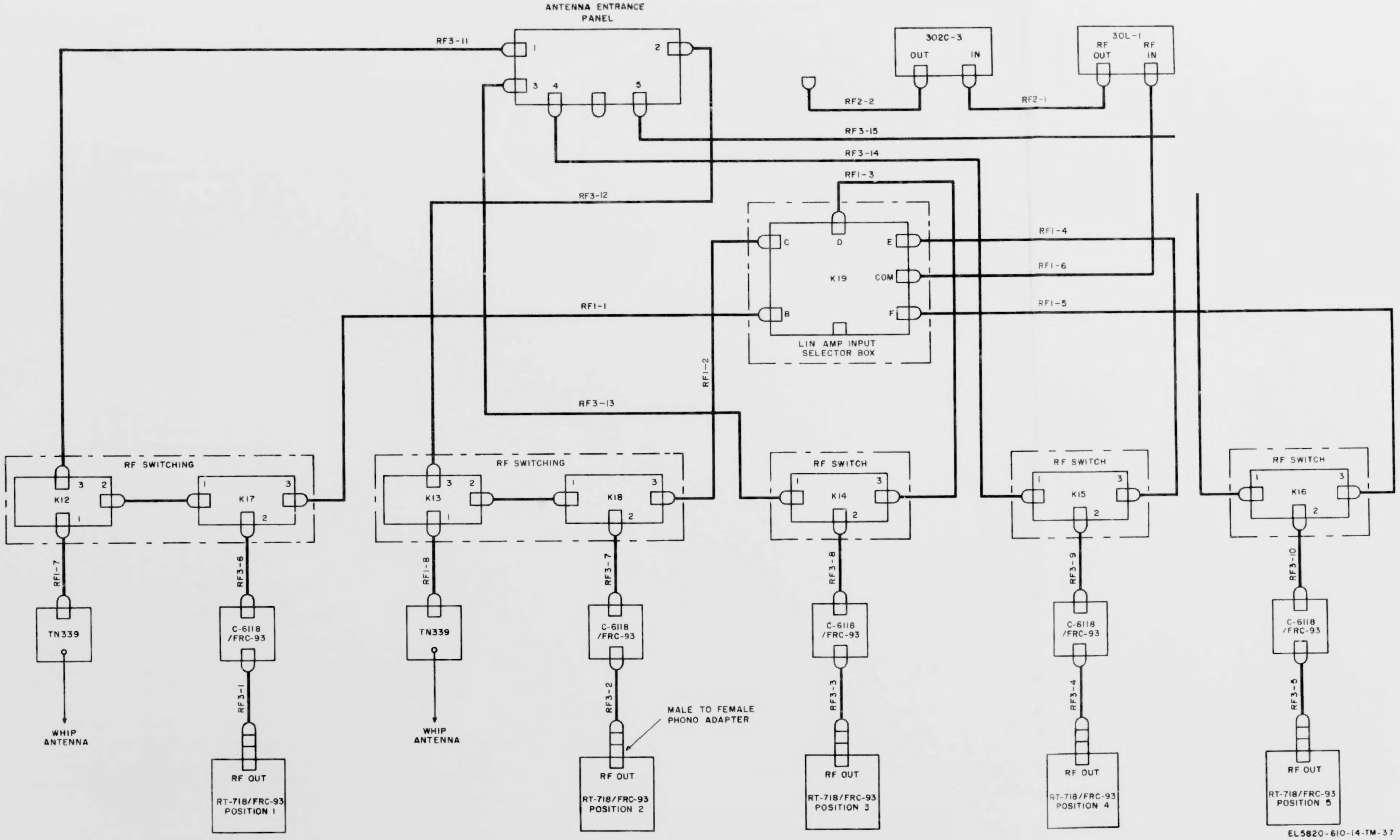
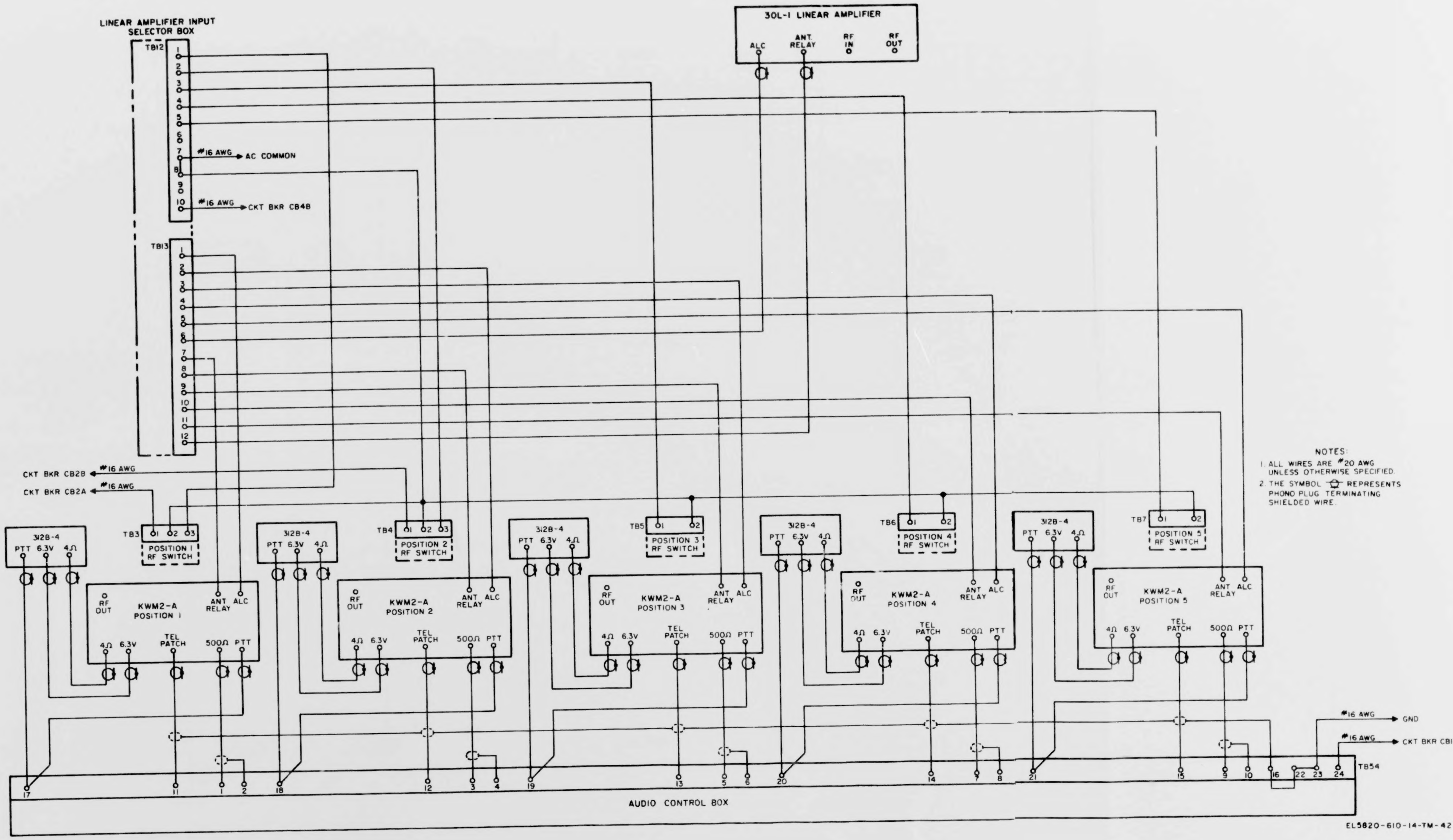

SIGNAL LIGHT CONTROL
CKT-1
CKT-2
CKT-3
CKT-4
CKT-5
+28V
SIG-1
LA-1
SIG-2
LA-2
SIG-3
LA-3
SIG-4
LA-4
SIG-5
LA-5
-28V
CUT
OUT
R9 R11 R12
R21 R23 R24
R33 R35 R36
R45 R47 R48
R57 R59 R60
TR1
TR2
TR3
TR4
TR5
DWG NO MP5-1F
EL5820-610-14-TM-39

Figure FO-6. Signal light control, printed circuit wiring.


ANTENNA ENTRANCE PANEL
1
2
3
4
5
302C-3
OUT
IN
30L-1
RF OUT
RF IN
RF3-11
RF2-2
RF2-1
RF3-15
RF3-14
RF1-3
RF3-12
RF1-4
RF1-6
RF1-5
RF1-1
C
D
E
K19
COM
B
F
LIN AMP INPUT SELECTOR BOX
RF1-2
RF3-13
RF SWITCHING
K12
K17
RF SWITCHING
K13
K18
RF SWITCH
K14
RF SWITCH
K15
RF SWITCH
K16
1
2
3
RF1-7
RF3-6
RF1-8
RF3-7
RF3-8
RF3-9
RF3-10
TN339
C-6118 /FRC-93
TN339
C-6118 /FRC-93
C-6118 /FRC-93
C-6118 /FRC-93
C-6118 /FRC-93
RF3-1
RF3-2
RF3-3
RF3-4
RF3-5
WHIP ANTENNA
WHIP ANTENNA
MALE TO FEMALE PHONO ADAPTER
RF OUT
RT-718/FRC-93 POSITION 1
RF OUT
RT-718/FRC-93 POSITION 2
RF OUT
RT-718/FRC-93 POSITION 3
RF OUT
RT-718/FRC-93 POSITION 4
RF OUT
RT-718/FRC-93 POSITION 5

EL5820-610-14-TM-37

Figure FO-7. Rf cabling diagram.


LINEAR AMPLIFIER INPUT SELECTOR BOX
TB12
TB13
#16 AWG
AC COMMON
#16 AWG
CKT BKR CB4B
30L-1 LINEAR AMPLIFIER
ALC
ANT RELAY
RF IN
RF OUT
CKT BKR CB2B
CKT BKR CB2A
312B-4
PTT
6.3V
4Ω
TB3
POSITION 1 RF SWITCH
TB4
POSITION 2 RF SWITCH
TB5
POSITION 3 RF SWITCH
TB6
POSITION 4 RF SWITCH
TB7
POSITION 5 RF SWITCH
KWM2-A POSITION 1
KWM2-A POSITION 2
KWM2-A POSITION 3
KWM2-A POSITION 4
KWM2-A POSITION 5
RF OUT
ANT RELAY
ALC
TEL PATCH
500Ω
GND
CKT BKR CB14
TB54
AUDIO CONTROL BOX
EL5820-610-14-TM-42

NOTES:
1. ALL WIRES ARE #20 AWG UNLESS OTHERWISE SPECIFIED.
2. THE SYMBOL ⊖ REPRESENTS PHONO PLUG TERMINATING SHIELDED WIRE.

Figure FO-8. Audio and control circuits, wiring diagram.

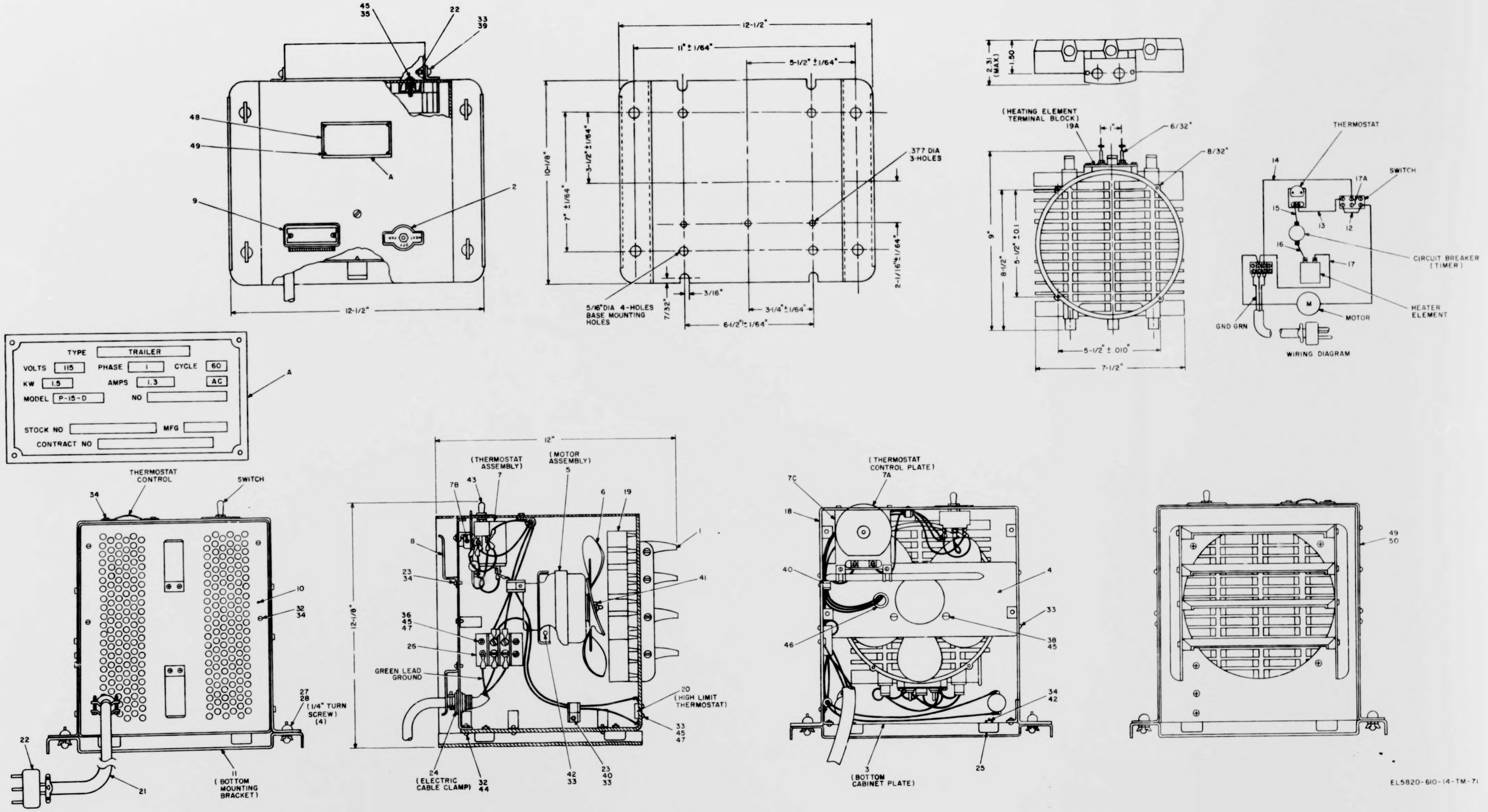

45
35
22
33
39
48
49
A
9
2
12-1/2"
12-1/2"
11" ± 1/64"
5-1/2" ± 1/64"
10-1/8"
3-1/2" ± 1/64"
7" ± 1/64"
.377 DIA
3-HOLES
2-1/16" ± 1/64"
5/16" DIA 4-HOLES
BASE MOUNTING
HOLES
7/32"
3/16"
3-1/4" ± 1/64"
6-1/2" ± 1/64"
2.31
(MAX.)
1.50
(HEATING ELEMENT
TERMINAL BLOCK)
19A
1"
6/32"
8/32"
9"
8-1/2"
5-1/2" ± 0.1
5-1/2" ± .010"
7-1/2"
THERMOSTAT
14
SWITCH
17A
15
13
12
16
CIRCUIT BREAKER
(TIMER)
17
HEATER
ELEMENT
GND GRN
M
MOTOR
WIRING DIAGRAM
TYPE TRAILER
VOLTS 115
PHASE 1
CYCLE 60
KW 1.5
AMPS 1.3
AC
MODEL P-15-D
NO
STOCK NO
MFG
CONTRACT NO
A
THERMOSTAT
CONTROL
SWITCH
34
10
32
34
27
28
(1/4" TURN
SCREW)
(4)
22
21
11
(BOTTOM
MOUNTING
BRACKET)
12"
(THERMOSTAT
ASSEMBLY)
(MOTOR
ASSEMBLY)
7B
43
7
5
6
19
1
8
23
34
41
12-1/8"
36
45
47
26
GREEN LEAD
GROUND
20
(HIGH LIMIT
THERMOSTAT)
33
45
47
24
(ELECTRIC
CABLE CLAMP)
32
44
42
33
23
40
33
(THERMOSTAT
CONTROL PLATE)
7C
7A
18
40
4
33
46
38
45
34
42
3
(BOTTOM
CABINET PLATE)
25
49
50
EL5820-610-14-TM-71

Figure FO-9. Electric space heater, Valad Model P15D, parts location.